FOREIGN EXCHANGE RATE EXPOSURE AND DETERMINANTS OF USING FOREIGN CURRENCY DERIVATIVES: AN EMPIRICAL STUDY ON PUBLIC LISTED FIRMS OF MALAYSIA

BY

ABDULLAH BIN OMAR

Thesis Submitted to
Othman Yeop Abdullah Graduate School of Business,
Universiti Utara Malaysia,
in Fulfillment of the Requirement for the Degree of Doctor of Philosophy

Kolej Perniagaan
(College of Business)
Universiti Utara Malaysia

PERAKUAN KERJA TESIS / DISERTASI
(Certification of thesis / dissertation)

Kami, yang bertandatangan, memperakukan bahawa
(We, the undersigned, certify that)

ABDULLAH OMAR (95919)

calon untuk Ijazah **DOCTOR OF PHILOSOPHY (FINANCE AND BANKING)**
(candidate for the degree of)

telah mengemukakan tesis / disertasi yang bertajuk:
(has presented his/her thesis / dissertation of the following title):

FOREIGN EXCHANGE RATE EXPOSURE AND DETERMINANTS OF USING FOREIGN CURRENCY DERIVATIVES : AN EMPIRICAL STUDY ON PUBLIC LISTED FIRMS OF MALAYSIA

seperti yang tercatat di muka surat tajuk dan kulit tesis / disertasi.
(as it appears on the title page and front cover of the thesis / dissertation).

Bahawa tesis/disertasi tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan, sebagaimana yang ditunjukkan oleh calon dalam ujian lisan yang diadakan pada: **2 Mei 2018.**
(That the said thesis/dissertation is acceptable in form and content and displays a satisfactory knowledge of the field of study as demonstrated by the candidate through an oral examination held on: ***2 May 2018).***

Pengerusi Viva *(Chairman for Viva)*	: **Assoc. Prof. Dr. Rohani Md Rus**	Tandatangan *(Signature)*	
Pemeriksa Luar *(External Examiner)*	: **Assoc. Prof. Dr. Noryati Ahmad**	Tandatangan *(Signature)*	
Pemeriksa Dalam *(Internal Examiner)*	: **Assoc. Prof. Dr. Nor 'Aznin Abu Bakar**	Tandatangan *(Signature)*	

Tarikh: **2 Mei 2018**
(Date)

Nama Pelajar (Name of Student)	:	**Abdullah Omar**
Tajuk Tesis / Disertasi *(Title of the Thesis / Dissertation)*	:	**Foreign Exchange Rate Exposure and Determinants of Using Foreign Currency Derivatives : An Empirical Study on Public Listed Firms of Malaysia**
Program Pengajian *(Programme of Study)*	:	**Doctor of Philosophy (Finance and Banking)**
Nama Penyelia/Penyelia-penyelia *(Name of Supervisor/Supervisors)*	:	**Assoc. Prof. Dr. Kamarun Nisham Taufil Mohd**
Nama Penyelia/Penyelia-penyelia *(Name of Supervisor/Supervisors)*	:	**Dr. Norzalina Ahmad**

Tandatangan

Tandatangan

PERMISSION TO USE

In presenting this thesis in fulfillment of the requirements for a Post Graduate degree from the Universiti Utara Malaysia (UUM), I agree that the Library of this university may make it freely available for inspection. I further agree that permission for copying this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor(s) or in their absence, by the Dean of Othman Yeop Abdullah Graduate School of Business where I did my thesis. It is understood that any copying or publication or use of this thesis or parts of it for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the UUM in any scholarly use which may be made of any material in my thesis.

Request for permission to copy or to make other use of materials in this thesis in whole or in part should be addressed to:

Dean of Othman Yeop Abdullah Graduate School of Business
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman

ABSTRACT

Financial theory holds that fluctuations in exchange rate significantly influence open market firms by affecting their cash flows and firm value. Because of high market openness and fluctuations in Malaysian exchange rate, this study, therefore, aims to investigate the extent to which 224 sampled firms of Malaysia face foreign exchange risk during the period of 2008 to 2014. Similarly, the continuous improvement in derivative market structure has enabled corporations to effectively manage their foreign exchange risk by using a variety of financial hedging tools such as foreign currency derivatives (FCDs). Therefore, the second aim of this study is to investigate the extent of the influence of foreign exchange risk and other firm's characteristics on the use of FCDs. This study employs ordinary least square model and logistic regression model to achieve first and second aim of the study respectively. Results show that the fluctuations in exchange rate significantly affect Malaysian firms' value during the sample period. It is also found that hedging pattern of Malaysian firms is significantly explained by the foreign exchange risk. The findings reveal that financial distress, firm size and exposure to foreign business operations significantly affect FCDs use. However, the study finds no support for risk management committee, underinvestment theory and liquidity hypotheses in explaining derivative use. This study contributes to relevant literature by introducing two new variables: foreign exchange rate exposure and risk management committee; using new market index and estimating both total and residual exposures. The results have implications for managers by guiding them to carefully consider highly risky currencies while making international transactions. This study has also implications for investors by guiding them regarding investment decisions; for Bursa Malaysia Derivatives Berhad in relation to offering new or improve existing derivative products and for Malaysian government to formulate risk management strategies at national level.

Keywords: foreign currency derivatives; currency risk; financial hedging; Malaysian firms

ABSTRAK

Teori kewangan menegaskan bahawa fluktuasi kadar pertukaran secara signifikan mempengaruhi firma-firma dalam pasaran terbuka dengan mempengaruhi aliran tunai dan nilai firma. Oleh kerana keterbukaan pasaran yang tinggi dan fluktuasi kadar pertukaran Malaysia, kajian ini bertujuan untuk menyiasat sejauh mana firma-firma di Malaysia menghadapi risiko kadar pertukaran asing dalam tempoh 2008 hingga 2014. Begitu juga penambahbaikan berterusan struktur pasaran derivatif telah membolehkan syarikat menguruskan risiko kadar pertukaran asing secara efektif dengan menggunakan pelbagai alat lindung nilai seperti derivatif mata wang asing (FCD). Oleh itu, matlamat kedua kajian ini adalah untuk mengkaji sejauh mana pengaruh risiko pertukaran mata wang asing dan ciri-ciri lain sesebuah firma ke atas penggunaan FCD. Kajian ini menggunakan model kuasadua terkecil biasa dan model regresi logistik masing-masing bagi mencapai tujuan pertama dan kedua. Keputusan menunjukkan bahawa fluktuasi kadar pertukaran asing secara signifikan mempengaruhi nilai firma di Malaysia sepanjang tempoh kajian. Ia juga menunjukkan corak lindung nilai firma-firma di Malaysia dapat dijelaskan secara signifikan oleh risiko kadar pertukaran asing. Penemuan ini mendedahkan bahawa ketenatan kewangan, saiz firma dan pendedahan kepada operasi perniagaan asing secara signifikan mempengaruhi keputusan penggunaan FCD. Walau bagaimanapun, kajian ini tidak menyokong pembolehubah jawatankuasa pengurusan risiko, teori pelaburan dan hipotesis kecairan bagi menjelaskan kegunaan derivatif. Kajian ini menyumbang kepada literatur yang relevan dengan memperkenalkan dua pembolehubah baru iaitu pendedahan kadar pertukaran asing dan jawatankuasa pengurusan risiko; dengan menggunakan indek pasaran baru dan menganggarkan jumlah keseluruhan dan pendedahan residual. Kajian ini memberi implikasi kepada pengurus firma dengan membimbing mereka membuat pertimbangan yang teliti terhadap risiko mata wang semasa membuat transaksi antarabangsa. Kajian ini juga memberi kesan kepada pelabur dengan membimbing mereka dalam membuat keputusan pelaburan Bursa Malaysia Derivatif Berhad dalam menawarkan produk derivatif baharu atau menambahbaik produk sedia ada dan kerajaan Malaysia untuk merangka strategi pengurusan risiko di peringkat negara.

Kata kunci: derivatif mata wang asing; risiko mata wang; lindung nilai kewangan; firma-firma Malaysia

ACKNOWLEDGEMENT

First and foremost, I would like to express my gratefulness and all thanks to almighty Allah for providing me this opportunity, the support and guidance and granting me the strength and ability to complete this work. Without HIS help and grace, I can never be able to achieve this goal or anything in my life.

I would like to strongly express my deepest gratitude, indebtedness and sincere appreciation to my both supervisors Dr. Kamarun Nisham Taufil Mohd and Dr Norzalina Ahmad. I am very grateful for their exceptional guidance, constructive comments, and, critical inputs, which assisted me to gain confidence and encouraged me to go much deeper into writing the research. I am very grateful for their immense knowledge and interest in my research area that made my thesis more interesting and significant. I appreciate their honesty, including compliments and criticisms.

The support of my family cannot be acknowledged enough and it is hard to express my thanks to my parents in words. It is impossible to describe how much I owe my father; Muhammad Umar Khan, and my mother; Soofia Umar, for their love, support, and patience. My parents suffer a lot as I am the only child of my parents who have been away for five years and could not be besides them when they needed. I will be always grateful to them as their support, courage and motivation make this achievement possible for me and their continuous struggle to make me successful in hereafter. I am very appreciative for their invaluable understanding, the faith, advises, intellectual spirit and indescribable support to me throughout my whole life.

I must say a big thank you and apology to my beloved family: my wife; Khunsa Khurram, and my both lovely sons; Muhammad Mutahir & Muhammad Talha, who have lived with every line and every page of this thesis and in our life together and much suffered from my absence. To my parents, wife and my sons I dedicate this work and to them I am forever indebted. I would like to express my special and sincerest gratitude to my wife who has always besides me and supported me spiritually with her patience and encouragement and share the burden of my postgraduate study. I sincerely apologize her for misbehave, rude and strict attitude, impolite talk, harsh words and indecorous behavior I ever did with her during study tenure. I am looking forward to many more happy and exciting years with her (In sha Allah).

Finally, I am also thankful for all my other family members, friends and colleagues that have contributed to the completion of this dissertation, whether in Malaysia or Pakistan. More importantly, I owe a debt of gratitude to my brother-in-law, Haris Khurram, for his time, support, encouragement and sacrifice specially during writing the last two chapters of this thesis. I also wish to deeply thank Saqib Ali, Atif Nawaz Baloch, Haseeb Bhatti and Muhammad Ramzan Zafar Ansari for their guidance, assistance, and coordination that they have offered to me. And last but not least, I wish to extend my sincere thanks to Mansha Yousaf for his unselfish support and generosity in a form of providing me peaceful and pin drop silence environment which become my big strength in pursuing this goal.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AUD	Australian Dollar
CAPEX	Capital expenditures as a percentage of total sales
ECU	European currency unit
FBMEMAS	FTSE Bursa Malaysia EMAS Index
FBMKLCI	FTSE Bursa Malaysia KLCI
FCDs	Foreign currency derivatives
FSTS	Foreign sales ratio
FX	Foreign exchange
GBP	Great Britain Pound
GDP	Gross domestic product
GFC	Global Financial Crisis
IASB	International accounting standard board
IFRS	International financial reporting standard
INCOV	Interest-coverage ratio
JPY	Japanese Yen
LIQ	Liquidity
LVRG	Leverage ratio
MM	Modigliani and Miller
MTBV	Market-to-book value ratio
MYR	Malaysian Ringgit
NPV	Net present value
OLS	Ordinary least square
PER	Price-earnings ratio
RM	Return on market index
RMC	Risk management committee
SGD	Singapore Dollar
SIZE	Firm's size
TWI	Trade-weighted exchange rate index
UK	United Kingdom
US	United States
USD	US Dollar
VIF	Variance inflation factor

Chapter 1 INTRODUCTION

1.1 Background of the Study

Breakup of the Bretton Woods system during 1970s, increased globalization of businesses, intense competition, market imperfections and political uncertainties introduced several global and financial risks and challenges for corporate sector. For firms that are involved in international business activities, such as exports and imports, their cash flows and firm value are largely affected by the changes in exchange rate, that ultimately rendering the management of foreign exchange (FX hereinafter) risk as an important element of firm's objectives (Bartram, 2008). Corporate risk management is now becoming the essential part of corporate business planning. The ultimate goal of risk management is to enhance firm value and therefore, benefit shareholders. According to Thomas-Olivier (2007), risk management maximizes value creation in three ways: providing financial flexibility, supporting better decisions and enabling operational and strategic flexibility. A great number of studies, such as Panaretou (2013), Choi, Mao, and Upadhyay (2013), Sheedy (2006), and Bartram (2000) discuss risk management strategies at corporate level of different markets such as UK, Hong Kong, and Singapore under various conditions.

FX rate risk is a type of financial risk in which value of a firm is possibly affected by uncertain changes in exchange rate (Hakala & Wystup, 2002). Past studies (Hekman, 1985; Marston, 2001; Shapiro, 1975) highlight the fact that fluctuations in exchange rates are a major source of macro-economic uncertainty which affect the decisions of individual and institutional investors, returns, cash flows and values of firms. Géczy, Minton, and Schrand

(1997) explain that the fluctuation in FX rates directly influences the current and expected cash flows of importing and exporting corporations and affect firm's level of profitability. Thus, the managers of multinational firms remain very much concerned about foreign trade agreements and free capital inflows/outflows, since these factors give rise to exchange rate risk of a firm. In addition, floating exchange rate system is followed by most of the countries (such as Indonesia, Thailand, and Malaysia), therefore corporate firms in these economies are highly exposed to exchange rate risk which, in turn, highlight the importance of implementing different risk management strategies and the need of hedging policies to mitigate FX rate risk (Afza & Alam, 2011).

Correctly measuring firm's FX rate risk and, particularly, identifying the main roots that exert this risk are of great importance for investors who want to know risk profile of their investment opportunity set and also for firm's management who have to take corporate investing and financing decisions for their firm (Rossi Júnior, 2012). FX rate fluctuations not only influence current and future expected cash flows or earning of multinational companies but also determine firm survival (Géczy et al., 1997). Without a clear set of risk minimization policies and strategies, use of derivative financial instruments can be extremely dangerous (Froot, Scharfstein, & Stein, 1994). This is abundantly clear by the numerous cases of derivatives trades that mismanagement, oversight, fraud and manipulation of risk management program and speculation with derivative instruments brought a series of huge trading losses and backfired several financial and nonfinancial corporations, such as Metallgesellschaft (loss from oil futures with the amount of $1.8 billion approximately in 1993), Procter & Gamble (loss from interest rate derivatives with the amount of $102 million approximately in 1994), Aracruz (loss from foreign currency

derivatives with the amount of $2.1 billion approximately in 2008), Sumitomo Corporation (loss from copper futures with the amount of $2.5 billion approximately in 1996), Kashima Oil (loss from foreign currency derivatives with the amount of $1.5 billion approximately in 1994), Societe Generale (loss from equity index futures with the amount of $7.6 billion approximately in 2008), Amranath Advisors (loss from gas futures with the amount of $7 billion approximately in 2006), and Orange County (loss from interest rate derivatives with the amount of $1.7 billion approximately in 1994) (Adam & Fernando, 2006; Culp & Miller, 1995; Froot et al., 1994; Jang & Fu, 2008; Karpinsky, 1998; Mello & Parsons, 1995, 2000; Stulz, 1996; Thomas-Olivier, 2007; Zeidan & Rodrigues, 2013). These disasters have alarmingly called for the top managers of corporate firms to shift more attention towards risk management programs and think what and how derivatives can play their substantial role in alleviating firm's risk (Allayannis & Ofek, 2001). Careful planning, appropriate hedging programs and their effective performance measurement is needed to help in preventing such occurrences (Sheedy, 2006).

The turbulences on the financial markets during the last decade have strikingly shown the importance of financial risk management for firms (Arnold, Rathgeber, & Stöckl, 2014). In an era of financial innovation, derivative financial instruments open a new avenue for corporate managers to facilitate them in achieving desirable pattern of firm's cash flows (Wang, 2009). The use of derivative instruments effectively allows firm's to buy and sell risk (Chalmers, 2001). The strong emergence of derivative financial instruments in last decade as the most cost-effective way to manage risks has triggered considerable interest among financial markets' participants. In order to make informed hedging decisions, it is imperative that financial managers are aware of the nature and extent of risks to which the

firm is exposed (Nguyen & Faff, 2003a). In addition, an effective corporate governance mechanism and financial regulatory authorities should enforce corporate firms to use available and appropriate hedging instruments to hedge and manage FX rate risk they expose (Zhou & Wang, 2013). The improvement in financial market structure and continuous innovation in hedging products have enabled corporations to effectively manage their FX rate risk by using a variety of tools. There are ample evidences and support provided by several empirical studies that financial hedging through derivatives is very much effective in alleviating FX rate risk (see Allayannis & Ofek, 2001; Bhuiya, Islam, Ahmed, & Haque, 2015; Ito, Koibuchi, Sato, & Shimizu, 2015; Kim & Kim, 2015; Nguyen, Faff, & Marshall, 2007 among others).

The popularity of foreign currency derivatives (FCDs hereinafter) as a hedging instrument provides an opportunity to researchers to explore their role in reducing FX rate risk (Yip & Nguyen, 2012). The use of FCDs assist firms to mitigate their risk arise due to unexpected fluctuations in foreign exchange rate (Hodgson, 1999; Shiu, 2007) and provide other benefits such as shareholders wealth maximization, reduce financial risk of a firm and lessen market imperfections (Hardwick & Adams, 1999). Existing literature reveals an increasing awareness among nonfinancial firms, particularly in exporting firms (e.g. Chiao & Hung, 2000; Ito et al., 2015; Pritamani, Shome, & Singal, 2004) about potential benefits gained by hedging FX rate risk. As Servaes, Tamayo, and Tufano (2009) argue that managing exchange rate risk is a dynamic and complicated process; thus, it demands the companies to effectively hedge their risk and to have well-thought-out strategies. In line with this notion, different firms implement different firm-wide policies regarding FX rate risk management through a variety of hedging strategies.

1.2 Motivation for the Study

There are two main motivations of this study. The first motivation is to examine the risk profile of Malaysian firms on how their firm value is affected by the changes in exchange rate. Previous studies on same subject provide ample and increasing evidences on open/emerging and closed/developed economies[1]. The empirical findings on both types of economies are quite different from each other. Generally, it is found that most of the open economies exhibit high level of FX rate exposure, while closed economies experience low level of FX rate exposure. FX rate exposure refers to the change in firm's stock returns due to the change in FX rates[2]. This is because foreign trade as a ratio of gross domestic product (GDP) (also called foreign trade-to-GDP ratio)[3] is usually high for open economies because they are open in nature, more involve in cross-border trade and having a large amount of payments and receipts in foreign currency, hence highly affected by exchange rate fluctuations. In contrast, closed economies have low imports/exports and less international transactions resulting in low foreign trade-to-GDP ratio, hence relatively low FX rate exposure.

[1] For open economies, see Friberg and Nydahl (1999), Hau (2002), Chen, Naylor, and Lu (2004), Calderón, Loayza, and Schmidt-Hebbel (2005), De Jong, Ligterink, and Macrae (2006), Fornés and Cardoza (2009), Hutson and Stevenson (2010) and Parsley and Popper (2006) among others. Similarly, for closed economies, see Agyei-Ampomah, Mazouz, and Yin (2013), El-Masry, Abdel-Salam, and Alatraby (2007), Bodnar and Gentry (1993), Baur and Miyakawa (2014), Khoo (1994), Nguyen and Faff (2003a), Pantzalis, Simkins, and Laux (2001), Li, Moshirian, Wee, and Wu (2009) and Shin and Soenen (1999) among others.

[2] Previous studies measured FX rate risk by examining the effect of exchange rate fluctuations on firm's stock return. They regress firm-level stock returns on exchange rate changes and referred the estimated coefficient of exchange rate changes as FX rate exposure (also sometimes called currency risk or exposure to FX rate). In literature, generally adopted FX exposure model is: $R_{it} = \beta_0 + \beta_1 XR_t + \acute{\varepsilon}_{it}$, where R_{it} is rate of return on firms' stock, XR is the changes in exchange rate in time *t*, β_0 & $\acute{\varepsilon}_{it}$ are intercept and error term respectively, and β_1 is referred as FX rate exposure. Further detailed discussion on FX rate exposure is given in Chapter 3.

[3] Also called 'Openness' and computed as: $\left[\frac{Imports+Exports}{GDP}\right] \times 100\%$

Thus, the first appealing rationale behind the first motivation of this study is the openness of Malaysian economy. Malaysia is a classic case of small, open and emerging economy, substantially relying on international trade and heavily plugged into the world economy. Its foreign trade-to-GDP ratio remained significantly high between 129% and 220% from 2000 to 2016. A comparison of trade (% of GDP) between Malaysia and three large closed and developed economies, i.e., US, UK and Australia, are given in Table 1.1. The values explicitly show that Malaysian foreign trade-to-GDP ratio remains significantly higher than those of developed countries and signifies the dependence of Malaysian economy over other economies with respect to ratio as depicted in Figure 1.1. From FX exposure viewpoint, Malaysian firms are more likely to be exposed to transactional currency risk primarily through import of raw materials, export of finished goods and revenues that are denominated in a currency other than the functional currency of the firms. Therefore, Malaysia could be one of the typical examples of small and open economy with a high probability of exposing FX rate risk.

A plethora of studies in the finance literature have investigated the exposure profile of closed and developed economies, but unluckily, open and emerging economies, particularly Malaysia, failed to get much of the attention of researchers towards this issue. This is one of the motivating factors which encourage the author to undertake study on Malaysia.

Table 1.1
Comparison of foreign trade-to-GDP ratio

Year	US (%)	UK (%)	Australia (%)	Malaysia (%)
2000	25	52	41	220
2001	23	52	44	203
2002	22	50	41	199
2003	22	49	40	194
2004	24	50	37	210
2005	26	52	39	204
2006	27	56	41	203
2007	28	52	41	192
2008	30	56	42	177
2009	25	54	45	163
2010	28	59	40	158
2011	31	63	41	155
2012	31	61	43	148
2013	30	61	41	143
2014	30	58	42	138
2015	28	56	41	134
2016	27	58	40	129

Source: *http://data.worldbank.org/indicator/NE.TRD.GNFS.ZS*

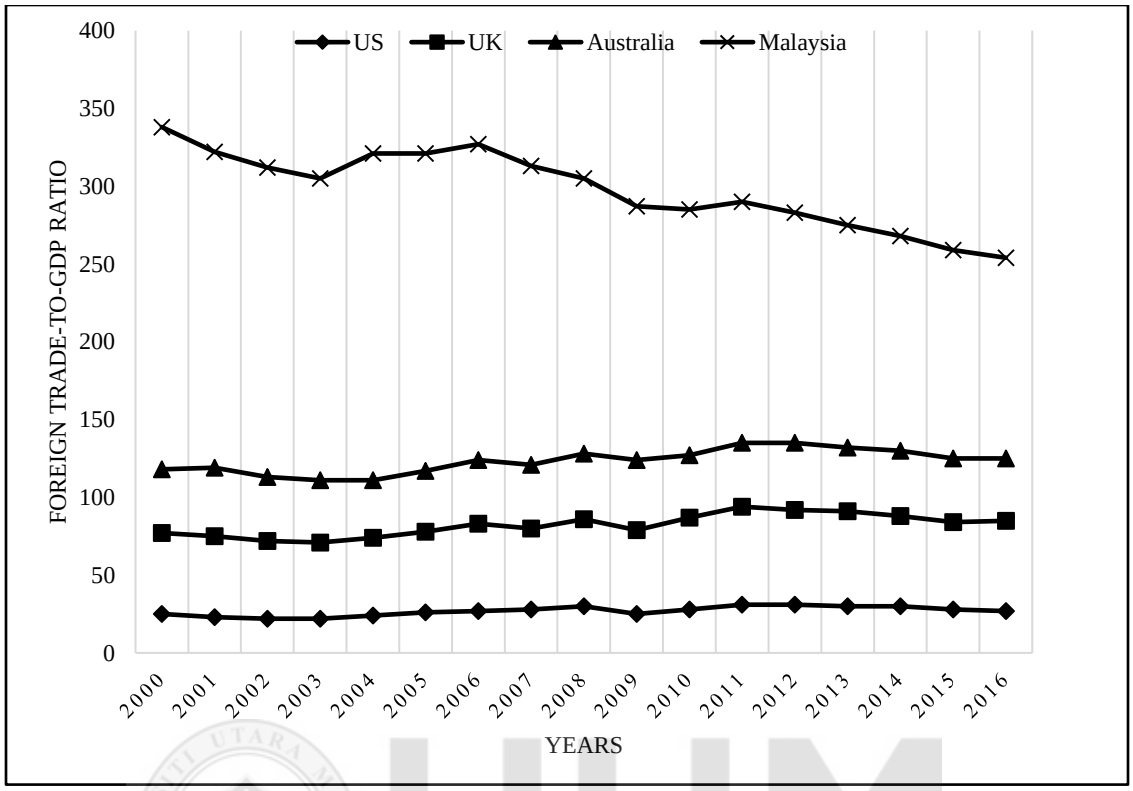

Figure 1.1
Comparison of Foreign trade-to-GDP ratio between US, UK, Australia and Malaysia
Source: *http://data.worldbank.org/indicator/NE.TRD.GNFS.ZS*

The second factor behind the first motivation of this study is the high volatilities in FX rate between Malaysian Ringgit (MYR) and United State (US) Dollar during the period of managed floating exchange rate which attract the attention of the author. From historical perspective, floating exchange rate system prevail twice in Malaysia: (i) January-1985 to September-1998; and, (ii) 22 July-2005 to date (Umezaki, 2006). In between these two periods, pegged (fixed) exchange rate regime was prevailed under which Ringgit was pegged against USD at RM 3.8/USD.

Figure 1.2 shows the daily changes in exchange rate between MYR and USD over the period of 1985 to 2017. It is evident from the figure that exchange rate fluctuations after

lifting pegged exchange rate system is strikingly higher compare to that of the period before pegging which implies that Malaysian firms are more likely to expose FX risk in later period as compared to former period.[4]

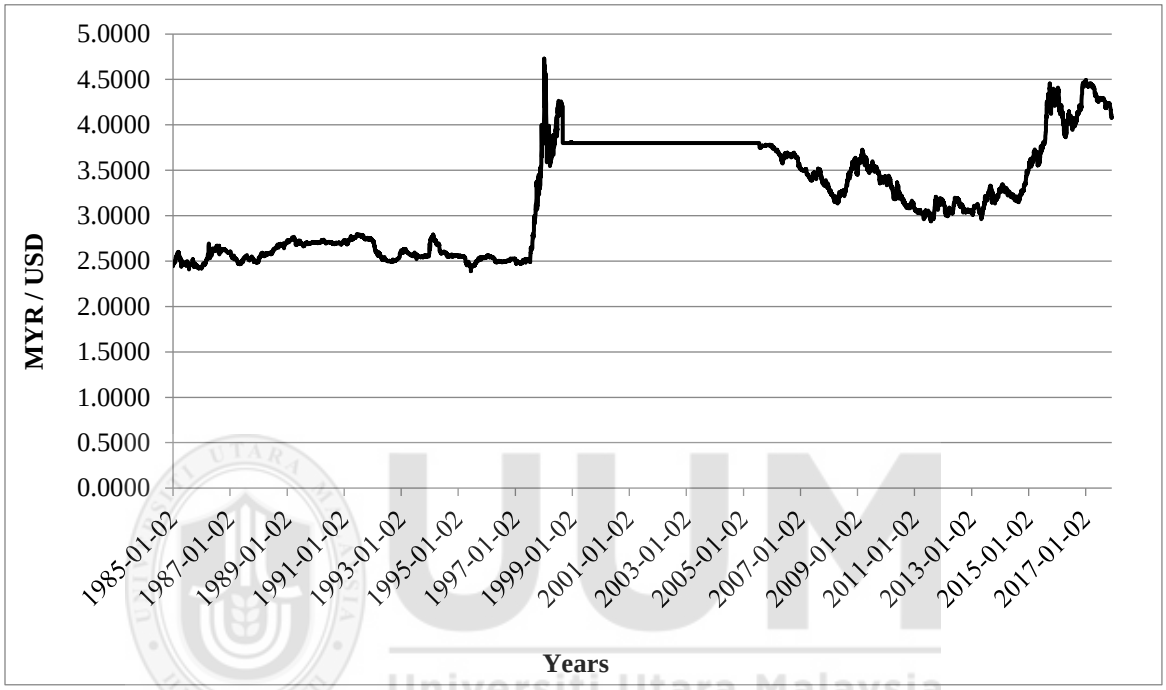

Figure 1.2
FX rate between MYR and USD over the period of 1985 to 2015
Source: Board of Governors of the Federal Reserve System (USA)

Unfortunately, the issue of examining exposure profile for Malaysian firms receive little attention of previous researchers and investigation of FX exposure for the latter floating exchange rate period is still unaddressed. Although, the attempt of Bacha, Mohamad, Zain, and Rasid (2012), Pillay and Rangel (2002), Tse and Tsui (1997) and Lim and Meera (2010) shed light on this issue, but none of the studies examined Malaysian FX exposure

[4] The variations in first floating exchange system are very low with the range of 2.3 to 2.7. Exceptionally, however, exchange rate becomes extraordinarily high and continuously increased after Aug-97 and touches the highest value of 4.73 in Jan-98 and remains around 3.96 (on average) from Dec-97 to Aug-98 which is possibly due to Asian financial crisis.

for the latter floating exchange rate period. To investigate the sensitivity of FX rates against stock returns during the later period of floating exchange rate system would be more meaningful and fruitful, because, the fluctuations in exchange rate are considerably high in this period as compared to other periods (see Figure 1.2). This shortfall represents a significant gap in empirical literature and warrants further research to address this issue. Therefore, this study investigates the FX rate risk of Malaysian firms for the later period of floating exchange rate system over the period of 2008 to 2014 in order to fill this substantial empirical gap. The latest period and updated data on exchange rates and stock returns are likely to provide generalized and robust results.

The second motivation of current study is to investigate the propensity of Malaysian firms towards the use of FCDs. Three potential issues warrant this investigation. Firstly, rationales for corporate risk management for developed economies have been subject to ample empirical investigation, including Joseph and Hewins (1997), Graham and Rogers (2000), Haushalter (2000), Mian (1996), Nance, Smith, and Smithson (1993), Ross (1996), Sprcic and Sevic (2012), Wang and Fan (2011), but unfortunately, little attention has been devoted for developing and emerging economies like Malaysia. This encourages the author to undertake this study on Malaysian economy.

Secondly, due to the lack of empirical evidences on Malaysia, several factors of corporate hedging have not been well addressed by past studies. Studies on Malaysia, such as Fazillah, Hui, and Azizan (2008), Ameer (2010) and Chong, Chang, and Tan (2014), fail to predict those factors that are more relevant and appropriate for Malaysian market and cannot provide conclusive and realistic evidences on corporate hedging determinants.

Ultimately, this limitation also stimulates the author to build an empirical model that can best describe the use of hedging instruments by Malaysian firms.

Finally, previous studies on Malaysia provide evidence on the influence of several hedging factors over the combined use of different derivative instruments, such as FCDs, interest rate derivatives and commodity price derivative (see, for example, Ameer, 2010; Ameer, Isa, & Abdullah, 2011; Shaari, Hasan, Palanimally, & Mohamed, 2013). The drawback of investigating the combine use of all hedging instruments is that the intention and purpose of using each derivative type is quite different from each other[5]. Thus, the determinants for using all derivative instruments together might be quite different from each individual type determinants. Furthermore, to explore the determinants of FCDs alone for Malaysian market is more relevant and appropriate because Malaysian firms are more likely to face high FX exposure due to two reasons: (i) high volatilities in Malaysian exchange rate (as shown in Figure 1.2); and, (ii) high market openness (as shown in Table 1.1). This ultimately leads the Malaysian firms towards the use of FCDs as compared to any other type of derivative instrument. Unfortunately, the determinants of FCDs are not solely and separately addressed for Malaysian market by any study.

These three aforementioned issues are the source behind the second motivation of this study and provide adequate reason for conducting this study. This study proposes a unique empirical model with the appropriate factors to test corporate hedging rationales by including two new variables (i.e. estimated coefficient of FX exposure and risk

5 For example, FCDs are used to hedge currency risk, interest rate derivatives are used to hedge interest rate risk, while commodity price derivatives are used to hedge price risk.

management committee)[6] that are considered to better describe the use of FCDs and deemed more relevant for Malaysian market.

1.3 Problem Statement

Trade openness refers to cross border trade of goods, services and financial assets between two or more nations (Rødseth, 2000). High level of openness indicates the high level of imports and exports of an economy and involvement of different foreign currencies for foreign payments and receipts. Simultaneously, if there are variations in exchange rates, then the amount of foreign payments and receipts become uncertain, cash flows become unpredictable, and, ultimately firm value would be affected. De Jong et al. (2006), Hutson and Stevenson (2010), Bodnar and Gentry (1993), He and Ng (1998), and Nydahl (1999) provide the evidence that economies who are more open in nature are more influenced by FX rate fluctuations.

Malaysian economy possesses both attributes; (1) high trade openness, and (2) high variation in exchange rates. Table 1.1 (in section 1.2) depicts that Malaysian foreign trade-to-GDP ratio remained between 150% to 200% over the period of 15 years (2000 to 2014) which is significantly higher than that of US, UK and Australia, which validates the openness of Malaysian market. Secondly, the volatilities in exchange rate between MYR and USD after the pegged exchange rate system are much higher than that of any other period as exhibited in Figure 1.2; this also validates the greater variability in FX rate during

[6] These variables are explained in next section.

the last decade. Therefore, these two attributes (high market openness and greater variability in exchange rate) validate that Malaysian firms are most likely to expose FX rate risk.

Most of the empirical studies focus developed economies like US, UK, Australia, France and Germany and observe their FX risk level, while Malaysian economy could not get much of the attention of past researchers in this area with the exception of few.[7] Therefore, this study covers this literature gap by investigating FX exposure of Malaysian nonfinancial firms for the period of 2008 to 2014.

High fluctuations in FX rate lead firms towards hedging. High FX exposure induces firms to use derivative instruments to: (1) mitigate their exposure; (2) smooth out their cash flows and earnings; (3) improve profitability and (4) enhance firm value as suggested by different studies such as Aretz, Bartram, and Dufey (2007), Carter, Rogers, and Simkins (2006), and Guay and Kothari (2003). FCDs are the key instruments primarily used to control FX exposure. FX exposure is not the only factor (but an important factor) of firm's decision to use FCDs as there are several other determinants that encourage firms to use FCDs. Most of the past studies provide evidence on combined use of derivatives (i.e. FCDs, interest rate derivatives, and commodity price derivatives) in relation to hedging determinants for different markets such as Alkebäck and Hagelin (1999) and Alkebäck, Hagelin, and Pramborg (2006) for Sweden, Purnanandam (2008) and Graham and Rogers (2002) for US, Jalilvand (1999) for Canada and Ameer (2010), Ahmad and Haris (2012) for Malaysia.

[7] These include Bacha et al. (2012), Pillay and Rangel (2002) and Tse and Tsui (1997).

However, some researchers, such as Ameer (2010), Shaari et al. (2013) and Chong et al. (2014), also explore the determinants of combined use of financial derivatives for Malaysian market but these studies fail to address the determinants of FCDs alone which is noticeable gap in literature.

The rationale and importance behind determining factors of only FCDs use is that Malaysian firms are more likely to face FX rate risk due to high fluctuations in exchange rate and high market openness; therefore, the proportion of using FCDs instruments in alleviating currency risk, is possibly higher than any other hedging instrument (such as interest rate derivatives and commodity price derivatives). In addition, most importantly, the impact of FX exposure on the use of FCDs is not specifically addressed so far, generally for developed and developing markets and particularly for Malaysian market by any previous study. For these reasons, this study intends to close these gaps in the literature by particularly investigating the factors that affect Malaysian firms' decision to use FCDs including a factor of 'FX exposure'. The other factors are discussed below.

Large number of Malaysian firms has a risk management committee (RMC) like audit, remuneration, and nomination committees. According to Abdullah and Ismail (2016), the RMC in a firm is responsible to identify the nature and extent of risks, evaluate the likelihood of such risks materializing, assess company's ability to reduce the incidence of risks, monitor the adequacy of risk management framework implemented and give recommendation of actions to the board of directors. RMC delineates and proposes measures to address four major types of risks; management risks, product and services risk, political & economic stability risk, and financial risk (Abdullah & Chen, 2010). FX rate

risk is measured and managed under the category of financial risk. Derivative financial instruments, used to mitigate firm's financial risk, are of complex nature and require adequate knowledge, skill and experience to deal with them. Hassan, Salleh, Yatim, and Rahman (2012) argue that existence of RMC in firms signifies that they have specialized sources to introduce and implement effective risk management program, equipped with advanced technology, qualified and trained staff to deal with risk, and access to derivative markets. Firms without RMC, have either lack of said competitive edges to control their risk or they are facing lower level of risk which does not require a separate formation of RMC.

Because of high probability of FX risk, due to high market openness and high volatilities in exchange rates, Malaysian firms are more likely to use FCDs. Therefore, being a complex nature of financial instruments, the use of FCDs at corporate level calls for the need of separate and organized structure inside the firm to effectively manage FX risk. The formation of RMC is exactly consistent with that need. If firms have RMC then they might be more induced towards the use of FCDs and able to mitigate their FX risk in a better way because of specialized resources and organized infrastructure of risk management in a form of RMC (Tuan-Hock, Lee-Lee, & Hishamuddin, 2012). Therefore, it can be hypothesized that the existence of RMC in a firm influences the management decision to use FCDs. Several Malaysian studies discuss RMC in different context. For example, Abdullah and Chen (2010) and Hassan et al. (2012) discuss RMC in relation to financial statement disclosure in Malaysian context. Similarly, Bates and Leclerc (2009) and Yatim (2010) discuss the relationship of RMC in relation to board structure. However, the role of RMC with respect to hedging determinants is not considered by past studies which is a substantial

gap in literature. Thus, by considering RMC as an individual and important factor of FCDs usage, this study fills this literature gap by examining the extent to which existence of RMC in Malaysian firms determine the use of FCDs.

This study also tests the theory of underinvestment. Froot, Scharfstein, and Stein (1993) hypothesize that an underinvestment problem arises when firms have inadequate level of internally generated cash flows to finance growth opportunities and external financing (raising external capital) is also sufficiently expensive (e.g., because of transaction costs). Therefore, in turn, they must reduce their investment spending and invest at suboptimum level. In this situation, risk management or hedging adds value to the firm since it helps to ensure that firms have adequate funds to take advantage from profitable growth opportunities. Firm's managers can use hedging instruments to enhance shareholder value by coordinating the availability of and need for internal funds. An effective risk management program can reduce underinvestment cost by reducing the variations in firm value. Thus, in order to test underinvestment hypothesis, this study employs capital-expenditure ratio and market-to-book ratio as a measurement of firm's growth opportunities to test underinvestment hypothesis.

Volatilities in cash flow can lead the firm towards the situation in which firm's existing cash flows are no longer sufficient to pay off fixed payments (such as interest payments, utility bills and wages) to their creditors on time. This often leads the firm towards insolvency and bankruptcy. Corporate risk management helps in reducing the likelihood of encountering such states and, therefore, reduces the expected cost associated with financial distress (Smith & Stulz, 1985). Lowering the chance of financial distress can also

increase the optimal debt-equity ratio and therefore the associated tax shield of debt (Leland, 1998; Myers, 1977). This study examines the theory of financial distress by using interest coverage ratio and leverage ratio to check how financial distress determines the use of FCDs for Malaysian firms.

Likewise, evidences on size incentives to hedge are mixed. Studies provide competing arguments for positive or negative relationship between firm size and derivative usage. Smith and Stulz (1985) argue that because of inverse relation between direct bankruptcy costs and size of a firm, small size firms may have greater incentives to hedge. External financing might be more expensive for smaller firms because they face higher financing transaction costs and greater information asymmetries, this also induce them towards hedging. Conversely, Nance et al. (1993) hypothesize that the due to economies of scale, small firms are less likely to hedge than larger firms, as the hedging activity offers significant information and transaction cost scale economies, implying that larger firms are more likely to hedge. This argument is consistent with the findings of Mian (1996) that hedging activities exhibit economies of scale. Thus, the relation between hedging and firm size is still an empirical question. Therefore, this study addresses this issue by examining the relationship between firm size and hedging decision for Malaysian firms.

Variations in FX rate influence the value of those firms that have foreign business operations over the years (Allayannis & Weston, 2001). Because the amount of foreign business transactions is usually denominated in foreign currency rather than functional currency of the firm, hence firms are more likely to be affected by movements in foreign exchange rate. Several studies find that firms with foreign business operations have high

FX exposure (such as Allayannis & Ofek, 2001; Dominguez & Tesar, 2006), and consequently more likely to be FCDs users. Foreign sales are found to be one of the important contributing factors for firms to hedge (Zhou & Wang, 2013). As Malaysia is an open economy, hence, firms are engaged in cross border trade through high imports and exports. Therefore, most of the Malaysian firms are likely to experience more FX rate risk and, in result, more likely to use FCDs to mitigate that risk. So, this study will examine to what extent foreign business operations of Malaysian firms determine the use of FCDs.

The substitutes of hedging also influence the decision of using derivative instruments. Nance et al. (1993) argue that the substitutes for hedging imply the likelihood that firm will use lesser derivative instruments for managing its risk. Firms that face liquidity problem are more expected to use derivatives as hedging will reduce the volatility of cash flows and smooth their earnings hence they become able to payoff their financial obligations. Several studies find that derivative users have lower liquidity (such as Afza & Alam, 2011). Firms with high liquidity have fewer incentives to take part in hedging activities because they are facing a lower probability of financial distress, and liquidity will work as a substitute of hedging (Shaari et al., 2013). Several studies check how liquidity level determines the derivative use. Berkman and Bradbury (1996), Lin, Phillips, and Smith (2008) and Bartram, Brown, and Fehle (2009), for example, find that hedging is negatively explained by firm's liquidity level, whereas Shaari et al. (2013) find opposite results. This study tests the effect of liquidity levels towards the use of FCDs.

1.4 Research Questions

On the basis of above discussion, following research questions should be answered:

1. To what extent Malaysian firms are facing FX rate exposure?
2. What are the factors that lead Malaysian firms towards the use of FCDs?
    a. How does FX exposure affect the use of FCDs?
    b. How does RMC in Malaysian firms determine the use of FCDs?
    c. What is the relationship between capital expenditure and FCDs use?
    d. What is the relationship between market-to-book value ratio and FCDs use?
    e. How does the interest coverage ratio affect firm's decision to use FCDs?
    f. How does the leverage ratio affect firm's decision to use FCDs?
    g. How does a size of a firm influence the decision of FCDs use?
    h. How does the use of FCDs respond towards the foreign sales level?
    i. Does firm's liquidity affect the use of FCDs?

1.5 Research Objectives

In the light of said research questions, following research objectives can be formulated:

1. To find out FX rate exposure of Malaysian firms.
2. To find out factors that lead Malaysian firms towards the use of FCDs.
    a. To examine the effects of FX exposure on FCDs use.
    b. To investigate the level of FCDs use determined by RMC in Malaysian firms.
    c. To determine the relationship between capital expenditure and FCDs use.
    d. To determine the relationship between market-to-book ratio and FCDs use.

e. To investigate the impact of interest coverage ratio on firm's decision to use FCDs.
f. To investigate the impact of leverage ratio on firm's decision to use FCDs.
g. To examine the influence of size on the decision to use FCDs.
h. To examine the effect of foreign sales on the use of FCDs.
i. To examine the effect of firm's liquidity on FCDs use.

1.6 Significance of the Study

The study is significant and makes contribution to the empirical literature in following ways. The investigation of FX exposure for Malaysian firms for the period of 2008 to 2014 is important for several reasons. Firstly, the floating exchange rate system prevails in Malaysia during this period and variations in exchange rate throughout this period are comparatively much higher than that of the earlier periods. Secondly, financial reporting system of Malaysia has fully converged with International Financial Reporting Standard (IFRS) and now Malaysian firms are preparing their financial statements and annual audited reports by complying fully with IFRS. Therefore, this study period (i.e. 2008 – 2014) is likely to project true FX exposure of Malaysian firms and provide more reliable and updated results.

Another noticeable contribution of this study is the estimation of total exposure as well as residual exposure for Malaysian firms. Most of the previous studies estimate residual FX exposure for different economies but, to the best of author's knowledge, no study has yet provided the deep insight into both types of exposure; total exposure and residual exposure,

for Malaysian economy. This is the first study who estimates total and residual exposure for Malaysian nonfinancial firms over the sample period[8].

In Malaysian market context, previous studies discuss the effect of different motivating factors of hedging in relation to all types of financial derivatives instruments (i.e. FCDs, interest rate derivatives and commodity price derivatives) (see, for example, Ameer, 2010; Ameer et al., 2011; Shaari et al., 2013). It means that different hedging factors explain the use of FCDs in combination with other derivative instrument such as interest rate derivatives and commodity price derivatives. But this relationship is not separately explored yet for FCDs, particularly in Malaysian context, and literature is silent about factors that influence the management decision of Malaysian firms of using FCDs alone. It is also important to individually explore FCDs' determinants because Malaysian firms are more likely to use FCDs because of high probability of exposure to FX risk due to high fluctuations in exchange rates and high market openness. Therefore, this study bridges this gap by developing a model comprised of those factors that are likely to better explain the use of FCDs by Malaysian firms.

The model, used to investigate the determinants of FCDs use, is further extended by introducing a new exogenous variable; the *coefficient of FX exposure* (estimated by following Jorion (1990) model)[9], with the intention to investigate how much use of FCDs is explained by estimated FX exposure of Malaysian firms. Using FX exposure's coefficient as a separate and individual determinant of FCDs use in a model is entirely a

[8] See Section 3.1 for detailed discussion about total and residual FX exposure.
[9] See *Stage-one Model: Estimation of FX rate Exposure* in section 3.4.1

new concept and important contribution in literature which has not been attempted before by any author. The rationale behind the inclusion of this variable is the assumption that FX exposure is one of the significant factors that motivate firms to use FCDs. In other words, it can be hypothesized that key motive behind the use of FCDs by Malaysian firms is the FX exposure that firms face and want to reduce.

This study makes an important and valuable contribution to current vein of empirical literature by introducing a new explanatory variable 'RMC' in a model while predicting the use of FCDs. So far, to the best of author's knowledge, previous studies who provide international evidences on the use of derivatives, did not discuss this notion that the demand of derivative instruments can also be influenced by RMC of a firm. Therefore, the relationship between RMC and FCDs use is tested and explored in this study.

Previous studies on developing and emerging economies test underinvestment hypothesis and show divergent results. Ameer (2010) and Bhagawan and Lukose (2014), for example, show positive and negative relationships for capital expenditure ratio and FCDs use for Malaysian and Indian economy respectively. Likewise, for market-to-book ratio, Fazillah et al. (2008) and Afza and Alam (2011) show negative and insignificant results for Malaysia and Pakistan respectively. Due to mixed support for underinvestment theory, current study contributes to literature by testing both proxies in empirical model in relation with FCDs use.

For the theory of financial distress, empirical results are overall fairly mixed regarding interest coverage ratio and leverage ratio. For interest coverage ratio, Géczy et al. (1997)

find negative, whereas, Berkman, Bradbury, Hancock, and Innes (2002) find positive relationship in relation to derivative use for US and Australian firms respectively. Similarly, for leverage ratio, Shaari et al. (2013) find positive, while Afza and Alam (2011) find negative relationship with the use of hedging instruments for Malaysian and Pakistani firms respectively. This study enriches the body of relevant literature by taking into account both proxies while testing the determinants of FCDs.

The comprehensive review of the existing empirical evidence provides surprisingly mixed empirical support for hypotheses about size (see, for example, Afza & Alam, 2011; Allayannis & Ofek, 2001; Ameer, 2010; Bartram et al., 2009; Nance et al., 1993; Nguyen & Faff, 2002 among others) and foreign business operations (see, for example, Afza & Alam, 2011; Ameer, 2010; Géczy et al., 1997; Lin et al., 2008 among others) at the firm level. This study, therefore, provides important extension to the existing body of literature by examining both hypotheses for Malaysian economy.

This study has significant practical implications for firms, investors, Bursa Malaysia Derivatives Berhad and Malaysian government. First, results reveal that USD and JPY yield high exposure respectively to Malaysian firms, therefore, managers of Malaysian firms should be careful when a firm makes international transactions in these currencies. They should formulate risk management strategies and hedging programs accordingly to control FX risk against these currencies, smooth their cash flows, improve firm's performance, and enhance firm value.

Second, the empirical results regarding FX exposure have practical implication for investors as well. The finding could assist investors to examine the sensitivity of Malaysian stock returns to FX rate movements in making investment and financial decisions. Findings guide them that if they have invested in firms that are net-exporters then they should also invest in net-importers to offset their positive and negative FX exposure. Results should also be relevant to those investors who under or overweight large multinational firms.

Third, results have implication for Bursa Malaysia Derivatives Berhad in offering new or improve existing derivative products to assist Malaysian firms in mitigating their FX exposure specially in a period of high fluctuations in FX rates. Finally, the study findings have implications for Malaysian government to formulate risk management strategies at national level to safeguard domestic firms that involve in cross-border trade and small & medium enterprises from FX rate risk, so that the reduction in FX rate risk may significantly and favorably affect the GDP and national income of Malaysian economy. Moreover, Malaysian government may impose taxes on firm's income generated through hedging strategies as this policy will increase government revenues at national level.

1.7 Scope of the Study

This study is limited to financial hedging techniques (e.g. derivative financial instruments) used by Malaysian firms and other techniques like use of foreign debt, operational hedging, and natural hedging are out of the scope of this study. This study is confined only to Malaysian nonfinancial firms listed in Bursa Malaysia. Non-listed firms and financial firms are out of the scope of this study because most of them are also market-makers in foreign

currency derivatives; hence, their motivation for using derivatives could be very different from that of the nonfinancial firms (Allayannis & Ofek, 2001). This study covers the period of 2008 to 2014. Reason of selecting this period is that volatilities in FX rate are comparatively high during this period and, secondly, all Malaysian firms are bound to follow IFRS issued by International Accounting Standard Board (IASB) for the preparation of their annual accounts. So, the firm level data after that period would be maintained by complying to the international financial reporting requirements and become more reliable, uniform and meaningful.

1.8 Structure of the Thesis

This thesis comprised of five chapters. Chapter one starts with the historical background of the study and then motivating factors are discussed that stimulate the author to undertake this study. Then, in problem statements, the problems and issues related to the topic are discussed to whom this study intends to solve. Considering research problems, research questions and research objectives are formulated. And finally, theoretical and practical contributions and significance of this study is discussed.

Chapter two provides a brief overview of some theories that has accumulated over the years about corporate risk management and usage of financial derivative instruments. After that, several studies are discussed that explore FX exposure of different developed and developing economies. At the end, the results and findings of those studies are discussed that address different factors influencing hedging decision of a firm.

Chapter three starts with research framework and then all hypotheses, which are tested in this study, are discussed. Afterwards, the method of measuring each variable and their proxies are briefly discussed. After that, the models that are used to estimate FX exposure and determinants of FCDs are illustrated along with short explanation of each variable. Rationale and justification behind the study period is provided in next section and, finally, the procedures of sample selection and data collection are discussed in detail.

The discussions of results are provided in Chapter four. This chapter starts with the discussion of results obtained from stage-one model. Initially, descriptive statistics is explained along with the magnitude and significance of the obtained coefficient of exchange rate at different significance levels. Afterwards, results are compared with previous studies. Similarly, results obtained while predicting FCDs use by using logistic regression model are given and discussed. Discussion starts with descriptive statistics followed by univariate analysis, correlation analysis and test of multicollinearity for predictors. Subsequently, the effect of all explanatory variables on explained variable is discussed one by one. After that, robustness tests are applied to test the results.

The final chapter of this study is Chapter five which conclude the whole research and give recommendations for future research. First, the overview of whole research process is explained briefly. Then, the empirical findings of the study are summarized. Next, the contribution and significance of this study is discussed along with the practical implication. In last, limitations of the study are discussed followed by the recommendation for future research.

Chapter 2 LITERATURE REVIEW

2.0 Introduction

Classical financial theory assumes that there is absolute perfection in capital markets. This implies that capital markets are extremely competitive and participants of these markets are not supposed to any type of friction. Highly competitive capital market subject to atomistic competition and there are a large number of firms and consumers which implies that no firm is in a position to disturb the market equilibrium; i.e. all firms are market price taker (Danthine & Donaldson, 2002). Absence of friction implies that there is no existence of any type of cost[10].

Shareholders, real owners of a corporation, are individuals and individuals are usually risk averse, hence they want proper management of financial risk. On the other hand, the firms, opposed to shareholders, believe that to stay away from risk management may be the best policy for them. This will cut the cost and increase the probability of their more earnings (Smith, 1995; Smith & Stulz, 1985). As portfolio theory suggest that risks associated to individuals are diversifiable and can be encountered by holding well-diversified portfolios. By relaxing this assumption, it can be said that if owners do not hold well-diversified portfolios then risk aversion is relevant for the firm.

[10] Frictions such as progressive tax rates, information and contracting cost, commissions, transaction costs, bankruptcy cost, agency cost, incomplete and asymmetric information, conflict of interest among stakeholders and financial distress cost.

The relationship between financial policies and firm's real cash flows has been first established by Franco Modigliani and Merton Miller in 1958 which is known as MM theory. Concisely, if we extend MM theory to risk management then MM theory states under perfect capital market that risk management is insignificant to the firm hence shareholders can do it at their own and management efforts regarding managing risk cannot affect firm value (Bartram, 2000; Smith, 1995; Thomas-Olivier, 2007; Tufano, 1998). However, from a different perspective, whether the use of derivatives to hedge risks is value increasing or decreasing is an empirical question when the premises of a perfect market have been relaxed. Previous researchers put forward several arguments on the relationship between firm value and corporate risk management by relaxing the assumptions in MM proposition.

Relevant theoretical and empirical studies that has accumulated over the years on the firm's risk management and the activities on the use of derivatives are reviewed in this chapter, which gives a critical review of the theoretical motives of derivatives usage, the extensive literature on FX rate exposures and, finally, the factors that drive the use of hedging tools by corporate firms.

2.1 Theories of Risk Management

Theoretical researches in the recent decades present a number of reasons of using derivatives by nonfinancial firms resulting from a variety of capital market imperfections. The following subsections will show how hedging increases firm value in presence of convex tax function. It is also shown that hedging with derivatives can mitigate sub-optimal

investment policies and reduce the contracting costs. Furthermore, the financial distress cost can be reduced from hedging which results from the inability to obtain sufficient income to cover the fixed claims. Prior to the investigation on how risk management can add firm value, it is imperative to grasp the mastery in foundations for modern corporate finance which originate from the Modigliani-Miller theorem.

2.1.1 The Modigliani-Miller Theorem

Classical financial theory relies on Modigliani and Miller (1958) (MM) model which provides a deeper insight to the modern philosophy of capital structure. The MM theorem on capital structure has established the foundations for modern corporate finance. MM theorem discuss those conditions in which firm's financial decisions are immaterial in enhancing its value. Following is the compact statement of Modigliani:

> "… with well-functioning markets (and neutral taxes) and rational investors, who can 'undo' the corporate financial structure by holding positive or negative amounts of debt, the market value of the firm – debt plus equity – depends only on the income stream generated by its assets. It follows, in particular, that the value of the firm should not be affected by the share of debt in its financial structure or by what will be done with the returns – paid out as dividends or reinvested (profitably)." (Modigliani, 1980, p. xiii)

Modigliani and Miller (1958) propose that in a presence of perfect capital market where there are no taxes, no transaction cost, and symmetry information, MM model shows that firm market value is unaffected and independent to how a firm is financed, what is its dividend policy and no matter how it raised its capital; either through stocks or debt. Risk management at corporate level will only be valuable if there are market imperfections in capital market like asymmetry information, limited commitments, and financial distress. In real, the financial markets are supposed to face variety of frictions as it is too hard to find frictionless market. This divergence between reality and theory create path for researchers to write extensively by relaxing the assumptions of MM model as they were questionable and deemed unrealistic. Past studies justify that in presence of capital market imperfection risk management can increase firm value. Several hedging theories introduce some frictions to classic MM model and arrive at optimal corporate hedging policies (Allayannis & Weston, 2001).

As a starting point, Modigliani and Miller's theorem originate a foundation to the generation of other theories which devote the essentials to corporate risk management. Financial theories suggest that hedging demand can be generated if one or more assumptions of MM theorem are relaxed. Three significant market imperfections are identified that induce firms towards hedging: *tax structure* (Mayers & Smith, 1982; Smith & Stulz, 1985), *underinvestment problem* (Froot et al., 1993) and *financial distress* (Froot et al., 1993; Mayers & Smith, 1982; Smith & Stulz, 1985). Under these market imperfections, firms get more hedging incentives and enhance firm value (Géczy et al., 1997).

2.1.2 Tax Structure

In some countries, tax functions are convex as they are progressive in nature. A progressive tax is a system in which tax burden increases with the increase in pre-tax earnings by following tax schedule (Moraly, 2011). Firms with high corporate earnings try to avoid higher marginal tax rates by reducing earning volatility. Mayers and Smith (1982), Stulz (1996) and Smith and Stulz (1985) assert that under progressive tax schedule, firms intend to smooth their earnings in order to minimize taxes which can be possible through risk management. Corporate risk management is expected to reduce variations in pre-tax income which results in lower tax burden. The greater convexity of tax schedule inspires firms for more risk management activities. In relation to increased debt capacity, Ross (1996) and Leland (1998) point out tax incentive to hedge. They argue that by the means of hedging, firms can make their cash flows less volatile and increase their debt capacity which, in turn, provides them tax-shield benefits.

Malaysia is not following progressive tax structure. Malaysian firms are taxed by flat tax rate. Under existing system of tax, resident firms of Malaysia are taxed at the rate of 25% till 2015. However, this tax rate will be reduced to 24% from 2016. On other hand, Inland Revenue Board of Malaysia has provided different classification of income types with different tax rates for non-resident firms. They are taxed at different rates depends upon the income type category in which they fall.

2.1.3 Underinvestment Problem

Froot et al. (1993) examine how hedging demand is determined by capital market imperfections. They provide framework for determining the impact of corporate hedging if firm is facing costly external financing. The theory states that if cost of obtaining funds from external sources is more expensive as compared to internally generated funds, the likelihood of using hedging instruments by firms is increased in order to ensure that firms have sufficient cash flows available to avail profitable investment opportunities. In such situation, firms with greater investment opportunities requiring funds will hedge their cash flows to avoid a short fall in the funds. Froot et al. (1993, pp. 1630-1631) explain the fundamental and important concept of cash flow hedging as follows:

> "A shortfall in cash may be met with some increase in outside financing, but also some decrease in investment. Thus, variability in cash flows now disturbs both investment and financing plans in a way that is costly to the firm. To the extent that hedging can reduce this variability in cash flows, it can increase the value of the firm."

Froot et al. (1993) argue that the decision of risk management relay on three conditions. First, firm have opportunities to invest in profitable projects whose net present value (NPV) is positive that enhance firm value. Second, the best source to fund these optimal investment opportunities is internally generated cash flows. If firm has shortage of internal funds, it will forego some profitable opportunities and invest at suboptimal level; and cannot get support from external financing as it is too costly to get. Third, the critical factor

of this problem, i.e. internally generated cash flows, are influenced by external factors such as changes in FX rates, interest rates and prices of different commodities. Under these circumstances, Froot et al. (1993) suggest that firm can assure and smooth its cash flows in order to invest in profitable and value enhancing projects. Subsequently, this theory is verified by several authors such as Gay and Nam (1998) who provide evidence on 486 nonfinancial US firms and find results consistent with Froot et al. (1993).

2.1.4 Financial Distress

Financial distress theory suggests that value of a firm can be enhance through appropriate hedging activities by mitigating volatilities in firm's cash flows and probability of financial distress (Mayers & Smith, 1982; Smith & Stulz, 1985). The term financial distress signifies the condition when a firm cannot meet (or meet with difficulty) its financial obligations toward creditors. With the increase in liabilities, interest payments or illiquid asset of a firm, the chance of financial distress also increases (Altman & Hotchkiss, 2006). Corporations face difficulty in paying their fixed claims when they are having higher financial distress. If financial distress is not considered seriously then it will lead the firm towards bankruptcy. Firms that face a situation of financial distress are more likely to inclined towards the use of hedging instruments for reducing their financial risk.

There are some types of cost that are associated with financial distress, known as cost of financial distress. The cost of financial distress has two major components: direct cost and indirect cost. The former refers to any fees or penalties that result from a bankruptcy, reorganization or liquidation. The latter refers to the cost arise from revenue loss, loss of

relations with customers and suppliers, foregone profitable opportunities, and extra cost for continuing business operations resulting in deterioration of firm's financial condition.

Firms have higher incentives to hedge if financial distress is costly, since firms can reduce the large portion of costs resulting from financial distress. Nance et al. (1993) argue that the extent of this cost reduction is based on two factors. First, the probability of a firm to face financial distress if it does not hedge; second, the cost a firm has to bear in case of facing financial distress. The greater the likelihood of distress (direct and/or indirect) the higher the benefits from hedging in a form of reducing expected distress costs to the firm.

Stulz (1996), Leland (1998) and Ross (1998) suggest that financial distress cost can be minimized if the probability of financial distress is reduced. It increases the firm's propensity of higher leverage which ultimately yields a benefit of greater tax shield which in turn increase firm value. The empirical evidences by Smith and Stulz (1985) and Froot et al. (1993) provide support to theoretical arguments that high likelihood of financial distress increases the probability of hedging and its associated benefits.

2.2 Review of Empirical Studies

There is a significant amount of research on the topic of corporate risk management. Some of these previous empirical studies attempt to explore factors that compel corporate firms to use hedging instruments, some studies measure FX exposure of different economies, and some studies explore the relationship between firm value and risk management. In

context to the scope of this study, literature is limited to studies about FX exposure and determinants of corporate hedging.

2.2.1 FX rate exposure

The preliminary work regarding the estimation of exposure resulting from exchange rate changes is introduced by Adler and Dumas (1984). They argue that exchange rate exposure refers to the changes in the firm's stock returns due to a unit change in currency exchange rate during a specific period of time. Their simple market model is specified as follows:

$$R_{it} = \alpha_i + \beta\, XR_t + \mu_{it}$$

Where R_{it} denotes the total return on common stock of ith firm in period t, XR_t denotes the change in exchange rate in period t, β is the sensitivity of stock return of ith firm due to unpredicted changes in FX rates, α is the intercept and μ is the error term of the model.

Although Adler and Dumas (1984) introduced a first model that estimates currency exposure, also referred as firm's total exposure (Martin & Mauer, 2005), which arises due to unanticipated movements in exchange rate, however, this model has some limitations which leads to an exaggerated estimation of FX rate exposure. Their model measures the impact of movements in FX rates on firm's stock returns. However, some macroeconomic factors also vary with the fluctuations in exchange rate and changes in stock return. Therefore, if they are not incorporated in the model then the estimated variations in stock returns that arise due to movements in FX rate may be exaggerated. These macroeconomic factors are unexpected inflation, the term premium on long-term government bonds,

industrial production growth, and changes in expected interest rate (Chen, Roll, & Ross, 1986; Jorion, 1990).

In consequence of this limitation, Jorion (1990) presents another model called 'augmented exposure model' for estimating exposure coefficient. This model also known as 'two-factor market model'. This model measures the 'residual' FX rate exposure after controlling macroeconomic factors in a form of adding market portfolio index in the model. Jorion examines exposure profile of 287 US multinational firms for ten years starting from 1971 to 1987 and reports that only 5.2% of the sampled firm significantly exposed to exchange rate changes. Subsequently, several authors employ Jorion's model in their studies for different economies and for different time periods. This study also follows Adler and Dumas (1984) model in main analysis and Jorion's model in robustness analysis to measure sensitivity of stock return of Malaysian firms resulting in fluctuations in FX rates.

Pritamani et al. (2004) examine both total and residual currency exposure for the year of 1997 using a sample of S&P 500 firms involve in exporting and importing activities. Their sample is further identified in sub samples of export oriented firms, import oriented firms and domestic firms. Results of total exposure indicate that 4% of the exporting firms sample exhibit significant negative total exposure while up to 43% of the sampled firms that are involve in import-oriented activities reveal statistically significant positive exposure. Finding of residual exposure reveal that importers are significantly and positively exposed by FX rate fluctuations while insignificant residual exposure is found for exporters.

Results of their study suggest that firms are significantly influenced by both foreign markets and the domestic economy. Likewise, Parsley and Popper (2006) conduct their study in nine Asia-Pacific countries and investigate the FX exposure of publicly traded firms during the period of 1990 to 2002; these include Thailand, Taiwan, Korea, Indonesia, Singapore, Hong Kong, Japan, Philippines, and Malaysia. They estimate both firm level total exposure and residual exposure for their sampled firms. Findings related to total exposure indicate that 49% of all sampled firms are significantly exposed to fluctuations in USD, while for Malaysian firms, 65% and 37% are significantly exposed to USD and Japanese Yen respectively. However, results of their residual exposure are slightly different from total exposure. Residual exposure results show that 61% and 13% firms are significantly exposed to USD and Japanese Yen respectively, while no exposure found against UK pound for sampled firms.

Similarly, Hutson and Laing (2014) test the relationship between firm's multi-nationality (as a proxy for operational hedging) and FX rate exposure for a sample of 953 US firms between 1999 and 2006. Overall, their results exhibit that 5.2% of the sample firms are significantly exposed to FX exposure. They find inverse relationship between firm's multi-nationality and use of FCDs and confirm the notion that that many of the international corporations have less propensity towards derivative instruments.

Loudon (1993) provides empirical evidence on the FX rate exposure of Australian stock during the period of 1984 to 1989. He provides evidence on a sensitivity of stock returns on Australian sampled firms relative to the changes in trade-weighted exchange rate index during the post float period starting from January-1984 to December-1989 by using time

series regression methods. Their exposure evidence is generally weak as only 6% of the sample firms had a significant exposure coefficient. Another comprehensive study of examining FX rate exposure for 24 Australian industry portfolios by using bilateral exchange rate was conducted by Di Iorio and Faff (2000) for the period of 1988 to 1996. The daily and monthly stock returns data exhibit 8% and 22% exposure for selected industries.

Bodnar and Wong (2003) investigate total exposure and residual exposure of a large sample of 910 US firms over the period of 1977 to 1996 from 1-60 month return horizon by using monthly stock returns. Results of total exposure estimate indicate that only 15% of the sampled firms are significantly exposed to exchange rate changes at 1-18 month return horizon, however, it increases from 20% to 50% as return horizon increases from 24 to 60 months. In estimation of residual exposure, they found that exposure remains between 20% to 25% for one to 21 months horizons but surprisingly shoot up to 60% for sixty-month return horizon.

Similarly, the exposure of 8 developing and industrialized countries, over the period of 1980 to 1999, is investigated by Dominguez and Tesar (2006) using both bilateral exchange rates and trade-weighted indices. They find relatively strong and significant FX rate exposure for their sample firms. They estimate exposure at both firm level and industrial level. At firm level, sample firms from 5 countries exhibit more than 20% significant FX rate exposure. On other hand, around 40% of industries show higher level of exposure from UK, Netherlands, Japan and Germany.

Allayannis, Ihrig, and Weston (2001) examine currency exposure for a sample of eighteen US manufacturing industry groups from 1979 to 1995. Their results show that around 22% of industry groups exhibit significant FX rate exposure. Al-Shboul and Anwar (2014) investigates the existence of weekly FX exposure in 13 Canadian industrial sectors over the period of 2003 to 2011. For the whole sample period, their study provide evidence for both linear and nonlinear exposure as well as exposure in pre and post global financial crisis periods. On the whole, they find weak support for full sample period as only 23% sectors of their sample (3 out of 13 sectors) exhibit significant FX exposure.

The comprehensive examination of FX rate exposure for 171 Japanese nonfinancial firms is carried out by He and Ng (1998) over the period of 1979 to 1993. Their results report that, out of total sampled firms, only 25% are significantly exposed to FX rate changes. Similarly, Bhuiya et al. (2015) examine the performance of 103 UK international firms listed in FTSE-20 during 2005 to 2010. They employ two-factor regression model and consider the sensitivity in stock returns as an indicator of firm's value. Their results cannot provide support for the effect of variations in FX rate in pound sterling on stock returns of UK firms. Results of regression model report that only 15% of the UK sampled firms are significantly exposed to FX rate changes, while 85% firms do not have any significant impact of exchange rate variations.

Nydahl (1999) examine weekly FX rate exposure of 47 Swedish firms during the period of 1990 to 1997. Findings show that only 26% of total sampled firms having significant FX exposure which is a larger percentage than other developed countries. Likewise, Du, Hu, and Wu (2014) test a conjecture on Taiwan economy that the insignificance of FX rate

exposure in developed economies might be due to the co-variations between market factor and FX rates. They use a sample of Taiwan firms for a period of 1991 to 2012. By using augmented exposure model, they find that 90% firms in their sample are significantly exposed to FX rate movements while all stock portfolios have significant FX exposure. Their firm level analysis confirms exposure conjecture that fluctuations in FX rates influence the Taiwan market by the co-movements with the market portfolio index.

De Jong et al. (2006) conduct their study on 47 Dutch firms to test the effect of movements in exchange rate on firm's stock returns. Their results reveal that more than 50% of their sampled firms are significantly affected by the volatilities in FX rates. Choi and Prasad (1995) develop a model of firm valuation for 409 United States corporate firms over the period of 1978 to 1989. Their findings reveal that firm value is significantly explained by exchange rate variations as 60% FX exposure of sampled firms gain from US dollar depreciation. But they observe some inter-temporal and cross-sectional variations in the coefficient of exchange rate risk and find limited support for FX rate fluctuations when data is combined into 20 SIC-based industry groups.

By using a sample of 109 Turkish firms between 1991 to 1998, Kiymaz (2003) investigates the exposure to FX rate variations. He finds that approximately 61% of Turkish firms exhibit significant exposure, while financial, chemical, machinery and industrial sectors exposed high degree of exposure. He also examines exposure with respect to pre and post-crisis period. Pre-crises period comprised of 1991 to 1994 while post-crisis period consists of 1994 to 1998. They find that exposure of all industries in pre-crisis period is greater than those of post-crisis period. Koutmos and Martin (2007) estimate total and residual exposure

to currency exchange rate for US nonfinancial firms. They use 7576 observations for decile portfolios over the period of 1973 to 2002 and 2763 observations for sector portfolios for the period of 1992 to 2002. Findings show that deciles and sector portfolios are positively and significantly exposed by FX rate movements as their total exposure is high, while they found negative signs for the residual model coefficients, however, most of them are insignificant.

The study of Bacha et al. (2012) provides evidence of the FX rate exposure of Malaysian firms listed in Bursa Malaysia. They use multivariate model consist of four bilateral FX rates to estimate exposure for 158 firms over a period of 1990 to 2005. Findings of their study exhibit that 71% of the Malaysian firms have significant exposure while USD is found to be the most dominant source of that exposure that affects 63% of sample firms.

The examination of FX rate exposure of 227 Japanese firms listed at Tokyo Stock Exchange (spreading across 15 industries) is undertake by Ito et al. (2015) during the period of 2005 to 2009. Results show that FX exposure significantly effects firm value of large Japanese manufacturing industries during a sample period, especially for 'Transport Equipment' industry as it largely depends on foreign sales. They also argue that higher USD invoicing inflates the currency exposure while through Yen invoicing and using financial and operation hedging, that exposure can be reduced. Similarly, by using a sample of 98 Australian firms of mining industry over the period of 1980 to 1987, Khoo (1994) does not find any support for exposure of mining firms resulting from exchange rate movements. The changes in stock return due to changes in FX rate are very small which

implies that Australian mining firms are not as significantly exposed to the changes in exchange rate as they are supposed to be.

Finally, the study of Priestley and Ødegaard (2007) investigate the exposure to US Dollar and European Currency Unit (ECU) for 8 industry indices of Norway over the period of 1983 to 1998. They find that all Norwegian industrial sectors are significantly and positively exposed to USD and negatively exposed to the ECU. All above studies related to FX exposure are summarized in Table 2.1.

Table 2.1
Literature summary of FX exposure

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Jorion (1990)	US	287 multinationals firms (1971 to 1987)	Two factor Jorion's market model	5.2% firms out of sample are significantly exposed to exchange rate movements
Pritamani et al. (2004)	US	Sample of Importing and exporting firms from S&P 500 (1997)	Firm level total and residual exposure model	For total exposure, 4% and up to 43% of the exporting and importing firms sample exhibit negative and positive significant FX rate exposure respectively. They found significantly positive residual exposure for importers and insignificant residual exposure for exporters.
Parsley and Popper (2006)	11 Asian-Pacific countries	100 largest firms in major market index of each country (1990 – 2002)	Firm level total and residual exposure model	For total exposure, 49% of all sampled firms are significantly exposed to fluctuations in USD, while for Malaysian firms, 65% and 37% are significantly exposed to USD and Japanese Yen, respectively. For residual exposure, 61% and 13% of Malaysian firms are significantly exposed to USD and Japanese Yen respectively.
Hutson and Laing (2014)	US	953 firms listed in NYSE, AMEX[11] and NASDAQ (1999 to 2006)	Two factor Jorion model and extended market model	Overall, 5.2% firms significantly exposed to FX risk. Domestic firms have highest exposure as opposed to globally multinational firms.
Loudon (1993)	Australia	141 listed firms (1984 to 1989)	Two factor Jorion's market model	6.4% of the sample firms significantly expose to FX rate risk

[11] NYSE stands for New York Stock Exchange, whereas AMEX stands for American Stock Exchange

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Di Iorio and Faff (2000)	Australia	24 Australian industry portfolios (January 1988 to December 1996)	Two factor augmented market model	With daily and monthly data, 8% and 22% of their industries, respectively, show significant exchange rate exposure
Bodnar and Wong (2003)	US	910 large US firms (1977-1996)	Firm level total and residual exposure model	For total exposure, 15% of the sampled firms are significantly exposed to exchange rate changes at 1-18 month return horizon, however, it increases from 20% to 50% as return horizon increases from 24 to 60 months. For residual exposure, 20% to 25% firms highly exposed FX risk for 1-21 months horizon and increased up to sixty percent for sixty months horizon.
Dominguez and Tesar (2006)	Developing countries[12]	2387 firms from 8 developing countries, 300 firms, on average, from each country (1980 to 1999)	Two factor augmented market model	Around 20% of the total sample firms significantly influenced by weekly changes in FX rates. Industrial exposure was over 40% in UK, Netherland, Japan and Germany.
Allayannis et al. (2001)	US	18 manufacturing industry US groups	Two factor augmented market model	22% of US manufacturing industries sample were significantly affected by exchange rate changes
Al-Shboul and Anwar (2014)	Canada	13 Canadian industry sectors (2003 to 2011)	Use linear, nonlinear and asymmetric effect models	23% of their sample firms significantly affected by FX rate fluctuations.

[12] The United Kingdom, Thailand, the Netherlands, Japan, Italy, Germany, France and Chile

Author(s)	Country	Sample (Period)	Methodology	Key Finding
He and Ng (1998)	Japan	171 Japanese multinational firms (January 1979 to December 1993)	Two factor Jorion's market model	25% of Japanese sample firms are significant positive exposure
Bhuiya et al. (2015)	UK	103 firms listed in FTSE[13]-250 index (2005-2010)	Two factor regression model	No significant relationship found for 85% of sample firms between changes in UK pound value and firm value
Nydahl (1999)	Sweden	47 Swedish firms (January 1990 to February 1997)	Two factor Jorion's market model	26% of the firms are significantly exposed to changes in FX rates
Du et al. (2014)	Taiwan	815 Taiwanese public listed firms as well as self-constructed twenty-five stock portfolios (1991–2012)	One, two, three, and four factor augment models	90% of sample firms have significant total exposure while all stock portfolios are significantly exposed to exchange rate changes
De Jong et al. (2006)	Dutch	47 Dutch firms (1994 to 1998)	Use two factor augmented market model & questionnaires	50% of Dutch firms are significantly exposed to volatilities in FX rates.
Choi and Prasad (1995)	US	409 multinational firms of US (1978 to 1989)	Two factor Jorion's market model	60% sample firms have significant FX rate exposure at the time of dollar appreciation
Kiymaz (2003)	Turkey	109 firms from Istanbul stock exchange (1991 to 1998)	Two factor augmented market model	61% of overall sample firms while financial industries, chemical, machinery and textile are more pronounced to exposure
Koutmos and Martin (2007)	US	7576 observations for Decile portfolios (1973 to 2002)	Used OLS for estimating total and residual exposure	Total exposure is positive and statistically significant for the deciles and sector portfolios.

[13] The Financial Times Stock Exchange

Author(s)	Country	Sample (Period)	Methodology	Key Finding
		2763 observations for Sector portfolios (1992-2002)		
Bacha et al. (2012)	Malaysia	158 firms listed in Bursa Malaysia (1990 to 2005)	Multivariate regression model	71% of firms expose significant exchange rate exposure during whole period
Ito et al. (2015)	Japan	227 firms listed at Tokyo Stock Exchange (2005 to 2009)	Use total and residual exposure models	Japanese firms have significant exposure to FX rate that have foreign sales and higher USD invoicing ratio.
Khoo (1994)	Australia	98 mining firms (January 1980 to March 1987)	Two factor Jorion's market model	Fewer Australian firms demonstrate significant exposure to exchange rate fluctuation
Priestley and Ødegaard (2002)	Norway	8 industry indices of Norway (1983 to 1998)	Use total and residual exposure models	All Norwegian industrial sectors are significantly and positively exposed to USD and negatively exposed to the European Currency Unit (ECU)

2.2.2 Determinants of Corporate Hedging

This subsection presents related empirical researches that focus on testing theoretical arguments about determinants of corporate hedging such as growth opportunities and financial distress.

2.2.2.1 FX Rate Exposure

High fluctuations in exchange rates affect stock returns of a firm and introduce exchange rate exposure in firm's risk profile. This exposure calls attention to the management for controlling that risk in order to smooth their cash flows and enhance firm value. FCDs are considered as one of main tools to reduce that exposure. The amount and magnitude of FCDs use varies according to the exposure that firm faces and ability to effectively use these instruments. Several studies attempt to investigate factors that affect firm's decision of using hedging instruments but the factor 'FX rate exposure' does not become a part of their model, whereas FX rate exposure is the prime motive for FCDs usage. This study, therefore, intends to fill this literature gap by investigating that how much exposure to FX rate, faced by Malaysian nonfinancial firms, determines the use of FCDs.

2.2.2.2 Risk Management Committee (RMC)

RMC, in public listed firms, is established to forecast the risk that firm is likely to face and develop risk management program to mitigate that risk. It deals with several types of risk including financial risk. The existence of RMC indicates that firm is serious about managing its risks. Existence of RMC in a firm signify that they have specialized sources

to introduce and implement effective risk management program, equipped with advanced technology, qualified and trained staff to deal with risk, and access to derivative markets. Firms without RMC have either lack of said competitive edges to control their risk or they are facing lower level of risk and do not require separate RMC. Hence, it can be assumed that firms, having RMC, are likely to face exchange rate risk and, in turn, become a FCDs user.

Although, there are several Malaysian studies that discuss RMC but in different contexts. Abdullah and Ismail (2016), for example, examine the effectiveness of RMC in influencing hedge accounting practices among non-financial firms listed on the Bursa Malaysia during 2013. Likewise, Abdullah and Chen (2010) and Hassan et al. (2012) explore the relationship between RMC and the disclosure level of financial instruments information from an agency theory perspective among Malaysian listed firms during 2008 and 1999 to 2003 respectively. Similarly, Bates and Leclerc (2009) and Yatim (2010) investigate the relationship between RMC and board structure for public listed firms of Malaysia during 2005 and 2003 respectively. Finally, Tuan-Hock et al. (2012) examine the relationships between RMC characteristics and risk taking of the Malaysia's insurance companies from 2003 to 2011. All these studies examine the role of RMC in different contexts but none of the study discuss RMC in relation to hedging determinants which is a substantial gap in literature. Therefore, this study uses RMC as an individual determinant of FCDs to test how much use of FCDs is explained by the existence of RMC in Malaysian nonfinancial firms.

2.2.2.3 Capital Expenditure Ratio

According to Froot et al. (1993), firms may face underinvestment problem and forego opportunities to invest in positive NPV projects due to shortage of internal financing and liquidity problem, while external financing is also expensive. In this situation, firm can reduce their cash flow volatilities by the means of hedging and utilize optimal growth opportunities by investment in profitable projects and avoid high cost of external financing. Several empirical studies test growth opportunities by a proxy of capital expenditure ratio and find mixed results. Shaari et al. (2013) and Ameer (2010), for example, conduct their studies on Malaysia and determine the use of derivatives by using a sample of 97 and 112 nonfinancial firms over the period of 2010–2011 and 2003–2007 respectively. Both studies find positive significant relationship for the capital-expenditure ratio in relation to derivative use. This implies that with the increase in capital expenditures, Malaysian firms will induce towards hedging. Similarly, Gatopoulos and Loubergé (2013) find that firms tend to use more FCDs with large capital expenditures. Thus, the positive association between capital expenditure of a firm and derivative use indicates that as the firm's growth is higher a firm is more likely to be exposed to more risks. Therefore, firm is more likely to hedge to reduce its risks due to huge investment growth.

Contrary to these studies, Bartram et al. (2009) provide evidence of derivative usage on 50 countries and find inverse relationship between derivative use and capital expenditure which is counter to the theory prediction. Consistent with Bartram et al. (2009), Bhagawan and Lukose (2014) find the capital expenditure ratio is negative and statistically significant to the extent of hedging in Indian market which suggests that Indian firms do not hedge to

increase their investment opportunities. Finally, during a period from 1991 to 2000, Fauver and Naranjo (2010) conduct their study on US 1746 headquartered and find insignificant relationship between derivative use and capital-expenditure ratio. All mentioned studies are summarized in Table 2.2.

Table 2.2

Literature summary of the relationship between capital expenditure and derivative use

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Shaari et al. (2013)	Malaysia	97 firms listed in Bursa Malaysia (2010–2011)	Panel Least Squares	Positive relationship between derivative use and capital expenditure
Ameer (2010)	Malaysia	112 firms listed in Bursa Malaysia (2003–2007)	Logit regression model and OLS	Capital expenditure and derivative use are positively associated with each other
Gatopoulos and Loubergé (2013)	Latin America	103 cross listed firms (2000 – 2002)	Leading indicators model	Firms tend to use more FCDs with large capital expenditures.
Bartram et al. (2009)	50 countries	7,319 firms from 50 countries (2000 – 2001)	Logit Model and Wilcoxon tests	Inverse relationship between derivative use and capital expenditure
Bhagawan and Lukose (2014)	India	S & P CNX 500 (2009 – 2010)	Tobit regression model	Capital expenditure ratio is negative and statistically significant to the extent of hedging
Fauver and Naranjo (2010)	US	1746 non-financial firms (1991 – 2000)	Logistic regression model	Insignificant relationship found between capital expenditure ratio and use of derivatives

2.2.2.4 Market-to-Book Value Ratio

From theoretical point of view, high market-to-book value ratio indicates high growth opportunities for a firm, which, in turn, induces managers to use derivatives in order to increase expectancy of utilizing investment opportunities. To test underinvestment problem, several studies use a ratio of market-to-book value as a proxy of growth opportunities and find mixed results. For example, Ameer (2010) finds that market-to-book value ratio and use of derivatives by Malaysian nonfinancial firms are positively associated with each other. Similarly, Lin et al. (2008) explore the relation between US firms and hedging activities and significant positive association was found between derivative use and market-to-book value ratio. Consistent with these results, Allayannis and Ofek (2001) provide evidence on US firm's hedging decisions and conclude that the use of hedging instruments are positively and significantly explained by market-to-book value ratio.

Contrary to aforesaid arguments, Afza and Alam (2011) find insignificant negative relationship between market-to-book ratio and derivative use while analyzing the pattern of derivative usage by public listed firms of Pakistan. Another study for Malaysian market was carried out by Fazillah et al. (2008) who investigate hedging behavior of Malaysian firms. Their study reveals that hedging decision of Malaysian nonfinancial firms is negatively affected by market-to-book value. Likewise, Géczy et al. (1997) also contribute in empirical literature of FCDs usage and reveal that FCDs use are negatively explained by market-to-book value ratio. In a same way, Gay and Nam (1998) conduct his study on US

firms for the period of 1996 and find that derivative usage is significantly influenced by market-to-book ratio. All aforesaid studies are summarized in Table 2.3.

Table 2.3
Literature summary of the relationship between market-to-book value ratio and derivative use

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Ameer (2010)	Malaysia	112 firms listed in Bursa Malaysia (2003–2007)	Logit regression model and OLS	Market-to-book value ratio and derivative use are positively associated with each other
Lin et al. (2008)	US	Fortune 500 and Business Week 1000 firms (1992–1996)	Probit regression	Significant positive association found between derivative use and market-to-book value ratio
Allayannis and Ofek (2001)	US	S&P 500 nonfinancial firms (1993)	Binomial probit model and truncated regression	Use of derivatives are positively and significantly explained by market-to-book value ratio
Afza and Alam (2011)	Pakistan	86 firms listed in Karachi Stock Exchange (2004–2007)	Logit regression model	Insignificant negative relationship found between market-to-book ratio and derivative use
Fazillah et al. (2008)	Malaysia	101 firms listed in Bursa Malaysia (2001 - 2005)	Two stage OLS regression model	Market-to-book value negatively affect the decision of Malaysian firms to use derivatives
Géczy et al. (1997)	US	Fortune 500 nonfinancial firms (1990)	Logit regression model	FCDs use are negatively explained by market-to-book value ratio

Gay and Nam (1998)	US	Business Week 1000 firms (1996)	Tobit regression model	Significant relationship found between hedging instruments and derivative usage

2.2.2.5 Interest Coverage Ratio

Expected cost of financial distress can be reduced through hedging which will lessen the variations in the firm value and reduce the probability of bankruptcy in case of high financial distress (Smith & Stulz, 1985). The association between hedging and financial distress is direct, which implies that firm will get higher incentive from hedging if it is facing higher cost of financial distress. Several proxies used by several studies to test the relation between hedging and financial distress. Most common proxies are interest coverage ratio and leverage ratio. Interest coverage ratio indicates the ability of a firm to pay finance cost on outstanding debt. Lower interest coverage ratio refers to high burden of debt cost on a firm and its ability to pay interest expense is questionable. This situation leads the firm towards hedging to get maximum benefits.

Several studies use interest coverage ratio as a proxy of financial distress and find divergent results. Afza and Alam (2011) test the ability of paying debt cost of Pakistani public listed firms and find negative and insignificant relationship between interest coverage ratio and derivative use. In a same way, Géczy et al. (1997), while providing evidence against currency derivative use, report that FCDs are negatively explained by interest coverage ratio. Similarly, Bartram et al. (2009) find inverse relationship between derivative use and interest coverage ratio for a large sample consist of more than 50 countries. Howton and Perfect (1998) provide separate evidence for derivative use for firms who use FCDs, interest rate derivatives and who use both types of derivatives. Interest coverage ratio is negatively related with firms who use both types of derivatives and interest rate derivatives but positively related with currency derivative users. Finally, Berkman and Bradbury

(1996) use two different samples to check how much firm's hedging decision depends upon different factors. For both samples, they find derivative use is negatively correlated with interest coverage ratio. All results are consistent with theory prediction that firms with more ability to cover its debt cost have less incentive to hedge. The summary of abovementioned studies is provided in Table 2.4.

Table 2.4
Literature summary of the relationship between Interest Coverage ratio and derivative use

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Afza and Alam (2011)	Pakistan	86 firms listed in Karachi Stock Exchange (2004–2007)	Logit regression model	Insignificant negative relationship found between interest coverage ratio and derivative use
Géczy et al. (1997)	US	Fortune 500 nonfinancial firms (1990)	Logit regression model	FCDs use are negatively explained by interest coverage ratio
Bartram et al. (2009)	50 countries	7,319 firms from 50 countries (2000 – 2001)	Logit Model and Wilcoxon tests	Inverse relationship between derivative use and interest coverage ratio
Howton and Perfect (1998)	US	451 firms of Fortune 500/ S&P 500 and 461 randomly selected firms (1994)	Tobit regression model	Total use of derivatives is negatively explained by interest coverage ratio
Berkman and Bradbury (1996)	New Zealand	116 firms listed on New Zealand stock exchange (1994)	Tobit regression model	Negative association found between interest coverage ratio and derivative use

2.2.2.6 Leverage Ratio

The most common proxy used by several studies to test firm's hedging decisions in financial distress situation is leverage ratio. Capital structure of a firm composed of two parts; debt and equity. High leverage ratio indicates that firm is facing high financial distress which is a dangerous situation not only for firm rather for all stakeholders, which ultimately could lead firm towards bankruptcy. Therefore, highly leveraged firms are more induce towards hedging and have more incentive from hedging than low leveraged firms. Several studies provide different evidence while investigating the relationship between hedging and leverage. Consistent with theory, Ameer (2010), for example, reports the direct relation between leverage and firm's likelihood of derivative usage.

Similarly, Shaari et al. (2013) find that highly leveraged firms of Malaysia are more intend to use derivatives. For large amount of sample, Bartram et al. (2009) find derivative users have significantly higher leverage. Howton and Perfect (1998) find that interest rate derivative users positively respond towards leverage as opposed to currency derivatives users. The study of Berkman and Bradbury (1996) on US firms also report the positive relationship between leverage and the use of derivative instruments. Likewise, Purnanandam (2008) conduct his study on large sample data and asserts that leverage influence firm's decision of derivative use positively, while high leveraged firms are less induced towards derivative usage.

Finally, Lin et al. (2008) also find positive correlation between hedging and leveraged firms of US. In contrast, study of Afza and Alam (2011) indicates the significant but negative

effect of leverage on likelihood of derivative use by Pakistani firms. Likewise, Allayannis and Ofek (2001) report same result that leverage is negatively associated with derivative use. Since high level of leverage lead the firms to more financial distress, so it makes difficult for firms to bear hedging costs such as management cost. For this reason, firms might do not hedge. The summary of aforesaid studies is illustrated in Table 2.5.

Table 2.5
Literature summary of the relationship between Leverage Ratio and derivative use

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Shaari et al. (2013)	Malaysia	97 firms listed in Bursa Malaysia (2010–2011)	Panel Least Squares	Positive relationship between derivative use and leverage ratio
Ameer (2010)	Malaysia	112 firms listed in Bursa Malaysia (2003–2007)	Logit regression model and OLS	Relationship between leverage ratio and derivative use is insignificant
Bartram et al. (2009)	50 countries	7,319 firms from 50 countries (2000 – 2001)	Logit Model and Wilcoxon tests	Positive relationship between derivative use and leverage ratio
Howton and Perfect (1998)	US	451 firms of Fortune 500/ S&P 500 and 461 randomly selected firms (1994)	Tobit regression model	Total use of derivatives is positively explained by leverage ratio
Berkman and Bradbury (1996)	New Zealand	116 firms listed on New Zealand stock exchange (1994)	Tobit regression model	Positive association found between leverage ratio and derivative use
Purnanandam (2008)	US	2000 listed firms (1996 – 1997)	Regression model	Leverage influence firm's decision of derivative use positively, while high leveraged firms are less induced towards derivative usage

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Lin et al. (2008)	US	Fortune 500 and Business Week 1000 firms (1992–1996)	Probit regression	Significant positive association found between derivative use and leverage ratio
Allayannis and Ofek (2001)	US	S&P 500 nonfinancial firms (1993)	Binomial probit model and truncated regression	Use of derivatives are negatively and significantly explained by leverage value ratio
Afza and Alam (2011)	Pakistan	86 firms listed in Karachi Stock Exchange (2004–2007)	Logit regression model	Negative significant relationship found between leverage ratio and derivative use

2.2.2.7 Firm Size

Most of the empirical studies on hedging determinants depict the derivative use as an increasing function of firm size. Afza and Alam (2011), for example, provide support for the direct relationship between size of a firm and usage of hedging instruments. Results of Allayannis and Ofek (2001) exhibit that use of derivatives are positively and significantly explained by firm size. Consistent with previous studies' results, Bartram et al. (2009) find positive impact of firm size on hedging decision. For Australian firms, Nguyen and Faff (2002) find firm size as an increasing function of derivative usage. For Malaysian market, Ameer (2010) and Fazillah et al. (2008) find that Malaysian firms respond positively towards hedging with regard to firm size. Finally, Nance et al. (1993) find positive correlation of firm size with hedging incentives.

However, Nance et al. (1993) also highlight some specific reasons of the effect of firm size on hedging incentives. Firstly, firms become bankrupt due to high financial distress which leads to liquidation and reorganization of assets and firms ultimately face direct legal costs. In proportion, these costs are less than firm size which implies that small size firms are more induce towards hedging. Secondly, pretax income of small size firms is likely to be reduced in progressive tax region, again implying that small size firms are more probable to incline towards derivative use. Finally, hedging policies at corporate level requires information scale economies, whereas larger firms have more specialized resources, trained staff to effectively implement hedging programs and use hedging instruments. This implies that large size firms are more probable to induce towards hedging. All these studies are summarized in Table 2.6.

Table 2.6
Literature summary of the relationship between Firm Size and derivative use

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Afza and Alam (2011)	Pakistan	86 firms listed in Karachi Stock Exchange (2004–2007)	Logit regression model	Positive relationship found between firm size and derivative use
Allayannis and Ofek (2001)	US	S&P 500 nonfinancial firms (1993)	Binomial probit model and truncated regression	Use of derivatives are positively and significantly explained by firm size
Bartram et al. (2009)	50 countries	7,319 firms from 50 countries (2000 – 2001)	Logit Model and Wilcoxon tests	Positive relationship between derivative use and firm size
Nguyen and Faff (2002)	Australia	469 public listed firms (1999-2000)	Logit Regression	Derivative usage is an increasing function of firm size
Nance et al. (1993)	US	Fortune 500 and the S&P 400 (1986)	Logit Regression	Positive relations of derivative use with firm size
Ameer (2010)	Malaysia	112 firms listed in Bursa Malaysia (2003–2007)	Logit regression model and OLS	Relationship between firm size and derivative use is positive
Fazillah et al. (2008)	Malaysia	101 firms listed in Bursa Malaysia (2001 - 2005)	Two stage OLS regression model	Firm size positively affect the decision of Malaysian firms to use derivatives

2.2.2.8 Foreign Sales

It is generally agreed that the unpredictability of firm's sale generated from foreign business operations and higher movement in FX rate influence the firms' cash flows pattern and level of profitability (Afza & Alam, 2011). Géczy et al. (1997) suggest that with high uncertainty in firm's cash flows due to higher level of foreign business operations and greater variation in FX rates results in greater potential benefits from FCDs use. Ameer (2010), for example, provide evidence on firm's hedging behavior of Malaysian firms and conclude that foreign sales significantly affect the decision of derivative use. Afza and Alam (2011) find significant positive effect of foreign sales on hedging decision by Pakistani public listed firms.

Likewise, Choi et al. (2013) investigate financial and operational hedging activities of 11,338 US pharmaceutical and biotech firms listed in COMPUSTAT database over the period of 2001 to 2006. By uing a logistic regression model, they find that firms with higher foreign sales and high international linkages at corporate levels are more likely to be users of derivaitves financial instruments. Similarly, Lin et al. (2008) report significant positive association between hedging and foreign sales by US firms. Géczy et al. (1997) also state that use of FCDs are more pronounced by foreign sales. All aforesaid studies are summarized in Table 2.7.

Table 2.7
Literature summary of the relationship between Foreign Sales and derivative use

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Ameer (2010)	Malaysia	112 firms listed in Bursa Malaysia (2003–2007)	Logit regression model and OLS	Relationship between foreign sales and derivative use is positive and significant
Afza and Alam (2011)	Pakistan	86 firms listed in Karachi Stock Exchange (2004–2007)	Logit regression model	Positive and significant relationship found between foreign sales and derivative use
Choi et al. (2013)	US	11,338 firms of COMPUSTAT (2001–2006)	Logistic regression model	Significant positive relationship found between foreign sales and derivative use
Lin et al. (2008)	US	Fortune 500 and Business Week 1000 firms (1992–1996)	Probit regression	Significant positive association found between derivative use and foreign sales
Géczy et al. (1997)	US	Fortune 500 nonfinancial firms (1990)	Logit regression model	FCDs use are positively explained by foreign sales

2.2.2.9 Liquidity

A firm's incentive to hedge with derivatives can also be influenced by its liquidity. If a firm has a good liquidity position, it has less incentive from hedging, since it is secured by sufficient funds to repay its debts. In these situations, more liquid assets assure bondholders that financial resources are enough to pay firm's fixed liabilities. As Smith and Warner (1979) argue that if firm is financially strong to pay its fixed claim then its expected cost and agency cost would also be lesser and, in turn, it would be less likely to induce towards hedging. Several studies try to investigate the extent to which liquidity influence the use of derivatives. Afza and Alam (2011), for example, find that nonfinancial firms of Pakistan negatively respond towards hedging with the level of liquidity. Findings of Lin et al. (2008) exhibit that liquidity level US firms is negatively associated with derivative usage.

The study of Géczy et al. (1997) on US firms suggest that FCDs use are negatively explained by liquidity of US firms. By using a large sample from fifty countries, Bartram et al. (2009) find significant and negative relationship between liquidity and hedging decision. Howton and Perfect (1998) find three different results for liquidity variable vis-à-vis different type of derivative instrument. Although the use of currency derivatives, interest rate derivatives and their combined use is positively explained by liquidity but none of the relationship is significant at 1% level of confidence. Berkman and Bradbury (1996) provide evidence for New Zealand firms that liquidity and hedging are negatively correlated with each other. In contrast, in Malaysian market context, Shaari et al. (2013) find that Malaysian firms are more tend towards hedging with the higher level of liquidity. On other hand, Ameer (2010) provide insignificant relationship between use of derivatives and liquidity level for Malaysian firms. All these studies are summarized in Table 2.8.

Table 2.8
Literature summary of the relationship between Liquidity and derivative use

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Afza and Alam (2011)	Pakistan	86 firms listed in Karachi Stock Exchange (2004–2007)	Logit regression model	Negative and significant relationship found between liquidity and derivative use
Lin et al. (2008)	US	Fortune 500 and Business Week 1000 firms (1992–1996)	Probit regression	Significant negative association found between derivative use and liquidity
Géczy et al. (1997)	US	Fortune 500 nonfinancial firms (1990)	Logit regression model	FCDs use are negatively explained by firm's liquidity
Bartram et al. (2009)	50 countries	7,319 firms from 50 countries (2000 – 2001)	Logit Model and Wilcoxon tests	Significant negative relationship between derivative use and liquidity
Howton and Perfect (1998)	US	451 firms of Fortune 500/ S&P 500 and 461 randomly selected firms (1994)	Tobit regression model	Total use of derivatives is negatively explained by liquidity

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Berkman and Bradbury (1996)	New Zealand	116 firms listed on New Zealand stock exchange (1994)	Tobit regression model	Negative association found between liquidity and derivative use
Shaari et al. (2013)	Malaysia	97 firms listed in Bursa Malaysia (2010–2011)	Panel Least Squares	Positive (with current ratio) and negative (with quick ratio) relationship between derivative use and liquidity
Ameer (2010)	Malaysia	112 firms listed in Bursa Malaysia (2003–2007)	Logit regression model and OLS	Relationship between liquidity and derivative use insignificant

2.2.3 Literature Gap

Synthesizing the above studies can be categorized into two sets. First set of literature examine exposure profile of different economies, while second set of literature examine the factors that force corporate firms to use financial derivative instruments. Although each set of literature provide arguments and evidences while discussing specific key issues with respective focuses, however, there are still some missing elements that need to be addressed. For example, exposure profile of developing economies is under-researched. Most importantly, Malaysian economy fail to get attention of previous studies who examine currency exposure of corporate firms. Similarly, none of the previous study provides evidence on FX exposure for Malaysian firms after lifting pegged exchange rate system which shows that volatilities in exchange rate are considerably higher compared to those before the pegging period.

As far as the second set of literature is concerned, several factors could not be incorporated by authors in empirical model that determine the need of hedging. Thus, the existing state of literature warrants further empirical investigation to bridge these two sets of literature with regards to FX rate exposure and firms' hedging activities to mitigate that exposure. This study, therefore, makes an effort to fill the gap by bridging the two sides in the contemporary empirical literature through examining the exposure profile of Malaysian firms and analyzing the influence of factors on corporate hedging activities over the period of 2008 to 2014.

Chapter 3 RESEARCH METHODOLOGY

3.0 Introduction

This chapter addresses the theoretical framework, hypotheses and other methodological aspects used to achieve objectives of the study. Section 3.1 explains the theoretical framework of the study in which the relationship between stocks prices at firm level and fluctuations in exchange rate is exhibited, as well as the relationship between propensity to use FCDs and other explanatory variables are also discussed. Section 3.2 discusses the hypothesis developed to test the effect of FX rate volatility on stocks prices and the influence of different factors on FCDs use. Econometric models that are used to test the relationship between different variables are discussed under section 3.3. Section 3.4 describes the proxies used to measure different variables. Period of study is discussed in section 3.5, and finally, procedure of sample selection and the sources from which the data is collected are discussed in section 3.6.

3.1 Research Framework

Several researchers empirically estimate *total* FX exposure[14] by regressing firms' stock returns on FX rate changes (e.g., see Adler & Dumas, 1984; Bodnar & Wong, 2003; Chow & Chen, 1998; Chow, Lee, & Solt, 1997a, 1997b; Du et al., 2014; Ito, Koibuchi, Sato, & Shimizu, 2016; Koutmos & Martin, 2007; Parsley & Popper, 2006; Priestley & Ødegaard, 2002; Pritamani et al., 2004). By following them, this study estimates total FX exposure of

[14] Refers to the exposure estimated without incorporating macroeconomic effects (i.e. market portfolio index) in exposure model (Bodnar & Wong, 2003; Dominguez & Tesar, 2006; Du et al., 2014; Koutmos & Martin, 2007; Pritamani et al., 2004).

Malaysian firms by examining the impact of FX rate fluctuations on a return of firms' stock. The relation between the firm's stock returns and FX rate movements is exhibited in Figure 3.1.

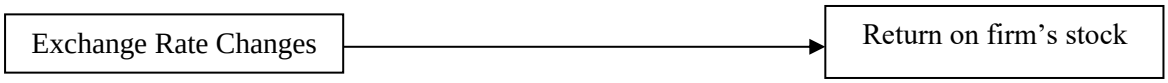

Figure 3.1
FX exposure of Malaysian nonfinancial firms

In the second step, this study tests the hypotheses related to corporate risk management in the context of propensity to use FCDs as depicted in Figure 3.2. For example, FX rate exposure is one of the major risks that encourage firms to use derivative instruments to hedge their risk. So, the use of FCDs is regressed on the coefficient of FX rate exposure which is estimated from stage-one model. Similarly, the effect of RMC in firms is tested against derivative usage by using dummy variable.

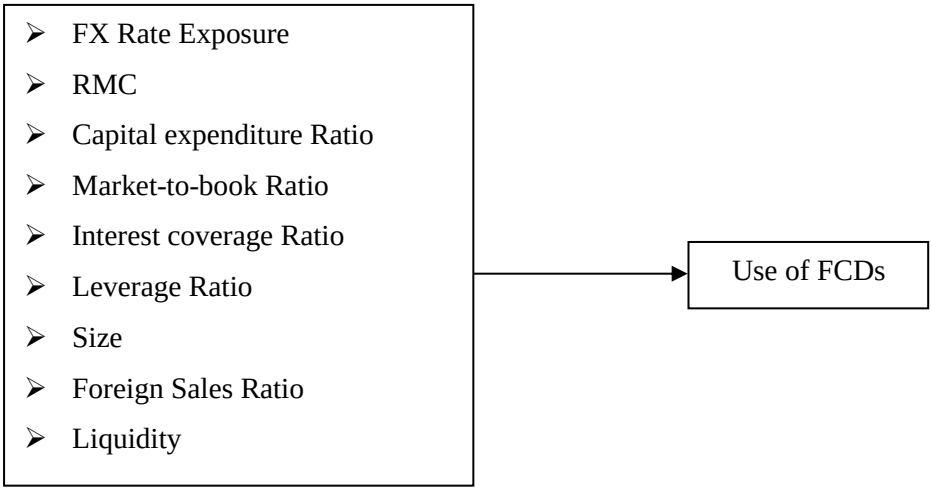

Figure 3.2
Determinants of FCDs use

The underinvestment theory states that when firm has an opportunity to grow by investing in positive NPV projects but firm's internal financial resources are too low to finance these projects and financing from external sources is also costly, then firm can smooth their cash flows by using optimal hedging policies. Froot et al. (1993), Myers (1977), Lessard (1991) and Stulz (1990) argue that firms may opt sub-optimal investment projects without hedging their risks because through appropriate risk management techniques, underinvestment problem can be reduced by reducing firm's dependency on external financing, as well as cost of external financing. Following Clark and Judge (2008), Hu and Wang (2005) and Judge (2006b), this study measures the theory of underinvestment with the help of two proxies. These are capital expenditure ratio and market-to-book ratio.

The financial distress theory suggests that firms that are more likely to face financial distress are more probable to opt hedging strategies (Mayers & Smith, 1982; Smith & Stulz, 1985). Two proxies are used to test the theory of financial distress: interest coverage ratio and leverage ratio. The arguments regarding size of firm in relation to hedging are still ambiguous. Similarly, foreign business operations give rise to the amount of foreign exchange in form of payments and receipts, which are highly affected by fluctuations in exchange rate. Therefore, the effect of firm size and foreign business operations on the decision to use FCDs are examined. Finally, the impact of liquidity, as hedging substitute, is also tested against the use of FCDs.

3.2 Hypothesis Development

This section provides arguments and support for the hypotheses developed for this study to test theories related to corporate risk management. There are ten hypotheses tested in this study.

3.2.1 Effect of FX Rate Fluctuations on Firm's Stock Return

Fluctuations in FX rates affect firm's value and its cash flows. Jorion (1990) argues that FX rate exposure represents the variation in firm value arises due to the fluctuations in FX rate. Several studies measure FX exposure by testing the impact of FX rate movements on stock return at firm level. Results of this relationship are heavily dependent on the nature of economy. Studies that are conducted on developed and closed economies find lesser FX exposure as compared to open and emerging economies' exposure. Amihud (1994), Jorion (1990), Zhou and Wang (2013), Loudon (1993), Bartov and Bodnar (1994) and Nguyen and Faff (2003a), for example, provide weak evidence for FX rate sensitivity on stock returns for developed and closed economies.

In contrast, various studies find that firms who operate in open and small developing economies are more likely to be sensitive from FX rate fluctuations. The studies of De Jong et al. (2006) on Netherlands and Hutson and Stevenson (2010) on 23 economies, for example, present evidence that stock returns of those firms that are operating in open economies are highly sensitive to FX rate movements. Similarly, He and Ng (1998) and Nydahl (1999) find that, respectively, Japanese and Swedish firms are highly affected by

exchange rate variations. In line with these arguments, it can be concluded that firms existing in more emerging and open economies are more likely to expose FX rate risk *vis-à-vis* closed economies. Since Malaysia is an open and emerging economy, therefore, it can be expected that Malaysian firms would be highly exposed to FX rate risk. In the light of above facts, the following hypothesis can be developed:

H_1: Malaysian firms are facing high FX rate exposure.

3.2.2 FX Rate Exposure

High fluctuations in exchange rates affect stock returns of a firm and introduce exchange rate exposure in firm's risk profile. This motivates the management of a firm to control that risk in order to smooth their cash flows and enhance firm value. FCDs are considered as one of main tools to reduce that exposure. The amount and magnitude of FCDs use varies according to the exposure that firm face and ability to effectively use hedging instruments. Several studies attempt to investigate factors that affect the decision of corporate firms to use financial derivatives but the factor 'FX rate exposure' does not become a part of their model, whereas FX rate exposure is the prime factor in raising the propensity to use FCDs. This study, therefore, investigates that how much exposure to FX rate, faced by Malaysian nonfinancial firms, determines the use of FCDs. Under this argument, a hypothesis can be established as follows.

H_2: There is a positive relationship between FX rate exposure and the use of FCDs.

3.2.3 Risk Management Committee (RMC)

To deal with different type of risks, firms might form a risk management committee (RMC) which is responsible to identify different kinds of risk and formulate strategies and policies to mitigate that risk and to reduce their adverse effects on firm performance. Four major kinds of risks fall under the jurisdiction of RMC, i.e. political and economic stability risk, product and services risk, management risks and financial risk. FX rate risk falls under the category of financial risk. In addition to other risks, RMC is responsible to forecast firm's risk arise due to variations in FX rate and design and implement hedging policies to encounter that risk with different types of derivative instruments such as FCDs. In other words, it can be said that firms with RMC are more likely to be derivative users. They are expected to use FCDs to mitigate their FX rate risk to enhance firm's value and profitability. Under this assumption we can develop following hypothesis regarding the relationship between RMC and use of FCDs:

H_3: There is a positive relationship between RMC and the use of FCDs.

3.2.4 Capital Expenditure Ratio

Froot et al. (1993) assert that firms may face underinvestment problem when they have opportunity to invest in a projects that have positive NPV but they face constraint on internal financing, while external financing is expensive. In this situation, firm can smooth their cash flows by the means of hedging and avoid high cost of external financing and avail optimal investment opportunities. Several theories test growth opportunities by a

proxy of capital expenditure ratio and find mixed results. Shaari et al. (2013) and Ameer (2010) find significant positive relationship between derivative use and capital expenditure ratio for Malaysian market. This implies that with the increase in capital expenditures, firms are induced towards hedging. Contrary to this argument, Bhagawan and Lukose (2014) find that capital expenditure ratio is negative and statistically significant to the extent of hedging in Indian market. For growth opportunities, this study uses a proxy of capital expenditure ratio and, in line with the empirical evidences, the relationship between capital expenditures and use of FCDs can be expected and hypothesis can be developed as follows:

H_4: There is a relationship between capital-expenditure ratio and the use of FCDs

3.2.5 Market-to-book Value Ratio

To proxy growth opportunities, several studies use a ratio of market-to-book value and find mixed results. Lin et al. (2008) and Allayannis and Ofek (2001), for example, conduct their studies on US nonfinancial firms and find that derivatives use are positively and significantly explained by market-to-book value ratio. Ameer (2010) and Fazillah et al. (2008) use same proxy for growth opportunities to test underinvestment theory for Malaysian market and find different results. Former finds positive, while later find negative influence of market-to-book value ratio on derivative usage. Similarly, Nance et al. (1993), Mian (1996), Géczy et al. (1997), and Graham and Rogers (2002) did not find any support for the underinvestment hypothesis with market-to-book value ratio as a proxy of growth opportunities. Finally, Afza and Alam (2011) estimate same relationship on Pakistani

nonfinancial firms but find insignificant results. In line with these mixed results, no definite conclusion can be drawn for the relationship between market-to-book value ratio and derivative use. However, considering aforesaid arguments the hypothesis about market-to-book value ratio can be formulated as follows:

H_5: There is a relationship between market-to-book value ratio and the use of FCDs.

3.2.6 Interest Coverage Ratio

Mayers and Smith (1982) and Smith and Stulz (1985) claim that the use of derivative financial instruments can reduce the expected cost of bankruptcy by reducing the volatility in firm value, which, in turn, mitigates the probability of firm's financial distress. Corporations face difficulty in paying their fixed claims when they are having higher financial distress. This situation leads them towards usage of financial derivative instruments to reduce their risk exposure. Several studies attempt to provide evidence on financial distress in relation to derivative use by using a proxy of interest coverage ratio and find divergent results. Afza and Alam (2011), Géczy et al. (1997), and Berkman and Bradbury (1996), for example, conduct their studies in Pakistan, US and New Zealand respectively and find inverse relation of derivative usage with interest coverage ratio. Similarly, Bartram et al. (2009) find that derivative use is negatively explained by interest coverage ratio. Conversely, Howton and Perfect (1998) find positive relationship between interest coverage ratio and FCDs use for US firms. In line of these mixed arguments hypothesis can be developed as:

H_6: There is a relationship between interest coverage ratio and the use of FCDs

3.2.7 Leverage Ratio

Financial distress is also tested by leverage ratio by several studies for different economies. The results are also mixed for leverage ratio in relation to hedging decision. Bartram et al. (2009), for example, find positive impact of leverage for derivative use for large sample of firms of fifty countries. Likewise, results of Purnanandam (2008) and Lin et al. (2008) suggest that high leveraged firms of US are more induce towards hedging. Consistent with theory, Berkman and Bradbury (1996) find that high leveraged firms of New Zealand are more inclined towards hedging. Shaari et al. (2013) and Ameer (2010) both provide evidence for Malaysian firms. Former find positive whereas latter finds insignificant relationship between leverage and hedging.

On the contrary, Afza and Alam (2011) find negative impact of leverage over the use of foreign currency derivatives for Pakistani firms. Similarly, the study by Howton and Perfect (1998) indicates that leverage has negative influence on the usage of FCDs. Finally, Allayannis and Ofek (2001) provide contradictory evidence for United State firms and find negative correlation between derivative use and leverage. Based on these empirical results, following hypothesis can be developed:

H_7: There is a relationship between leverage ratio and the use of FCDs

3.2.8 Firm Size

The relationship between firm size and derivatives is ambiguous and still an empirical question. However, most of the researchers argue that large size firms have more propensity to use derivative instruments as opposed to smaller firms. Géczy et al. (1997) suggests that firm size is associated with significant informational scale economies to establish the use of derivatives for hedging. They also argue that smaller firms are not as much of capable to hedge their risk because the hedging cost is a big constraint for them. Similarly, Ameer (2010) and Fazillah et al. (2008) both find that large Malaysian firms use financial derivative instruments to hedge their risk. Nguyen and Faff (2002) provide evidence for Australian market and find size as a positive and significant determinant of hedging. Afza and Alam (2011) find size as an increasing function of derivatives use for Pakistani public listed firms. Likewise, Allayannis and Ofek (2001) and Bartram et al. (2009) find that larger size firms have more propensity to use derivatives than smaller firms. On the contrary, Nance et al. (1993) argue that a situation of financial distress may become a cause of firm's bankruptcy and firm face several types of legal costs. Large firms are more able to meet these cost as opposed to small firm implying that small firms have more probability to hedge. In conclusion, most studies find a direct relationship between size of a firm and hedging through derivatives, therefore, the following hypothesis for firm size can be developed.

H_8: There is a positive relationship between firm size and the use of FCDs

3.2.9 Foreign Sales

For firms with foreign business operations, their value is likely to be influenced by FX rate variations (Allayannis & Weston, 2001). Because the amount of foreign business transactions are normally settled in foreign currency (which is different from functional currency of a firm), hence firms are more probable to be effected by the changes in FX rate. Zhou and Wang (2013) argue that foreign business activity is one of the most important factors for firms to hedge their risk. Several studies in literature find direct relationship between hedging and foreign sales. Ameer (2010) and Afza and Alam (2011), for example, test foreign sales as a determinant of derivative use for Malaysian and Pakistani market. Both find foreign sales as an increasing function of firms' hedging. Similarly, Lin et al. (2008) find that US firms that have high foreign sales are more likely to use derivatives. Finally, Géczy et al. (1997) also find direct significant relationship between foreign sales ratio and use of FCDs for US firms. Therefore, following hypothesis can be formulated for foreign sales variable.

H_9: There is a positive relationship between foreign sales and the use of FCDs

3.2.10 Liquidity

Liquidity works as a substitute of hedging. Firms with more liquid assets have less incentive to hedge since they have adequate funds to payoff their financial obligations and safe themselves from financial distress. Most of the past studies find that firms that have high level of liquid assets are less induced to hedge. The study by Afza and Alam (2011),

for example, find significant indirect relation between derivative use and firm's liquidity for Pakistani nonfinancial firms. Similarly, Lin et al. (2008) and Géczy et al. (1997) both provide similar results for US firms that use of derivatives are negatively explained by liquidity. For a large number of firms from 50 countries, Bartram et al. (2009) find negative and statistically significant results for liquidity in relation to hedging. Likewise, Berkman and Bradbury (1996) and Howton and Perfect (1998) conduct their studies on US and New Zealand firms respectively. Both determine negative relationship between liquidity and derivative usage. Finally, Shaari et al. (2013) and Ameer (2010) both provide evidence for Malaysian market. Former results vary with the change in measurement proxy of liquidity, while latter results are significant for liquidity and derivative use. Based on these facts, following hypothesis can be drawn for liquidity.

H_{10}: There is a relationship between liquidity and the use of FCDs

3.3 Model Specification

There are several methods to test the degree of relationship among explanatory variables but this study use ordinary least square (OLS) method and logistic regression model by following Muller and Verschoor (2007), Nguyen and Faff (2003a), Judge (2006a) and Khumawala, Ranasinghe, and Yan (2016). The impact of FX rate randomness on firms' stock return is estimated through OLS model, while propensity towards the use of FCDs by Malaysian firms is tested by logistic model in relation with different explanatory variables. Both models are briefly discussed below.

3.3.1 Stage-one Model[15]: Estimation of FX rate Exposure

The first exposure model is introduced by Adler and Dumas (1984) used to estimate sensitivity in firm's value due to the volatilities in FX rates. Several studies use this model to examine exposure profile of corporate firms related to different economies. Thus, by following Adler and Dumas (1984) approach, this study uses the same empirical model in order to capture variations in stock returns due to fluctuations in exchange rate and can be specified in following form:

$$R_{it} = \beta_0 + \beta_1 TWI_t^{JPM} + \acute{\varepsilon}_{it} \qquad \textit{(Equation 3.1)}$$

where;

- R_{it} is the rate of return on a common stock of *i*th firm in period *t.* Selection of different return horizons, such as daily, weekly, bi-weekly and monthly, remains controversial in previous studies from several aspects. Several researchers are in favor of using daily data (over monthly). Di Iorio and Faff (2000), for example, assert that monthly data is not appropriate to capture changes in FX rates. Similarly, the findings of Chamberlain, Howe, and Popper (1997) confirm the greater FX sensitivity in the model by using daily as compared to monthly data. Their study reports that results sensitivity can better explained through daily data than monthly data. Therefore, following the assumption that short horizon explains better measurement of FX exposure, this study uses daily return data. However, for the

[15] Also sometimes referred as '*exposure model*'

test of result robustness, the analysis using weekly and monthly data is performed and discussed in next chapter.

- TWI_t^{JPM} is the JP Morgan Trade-Weighted Exchange Rate Index (TWI) used as a proxy for the movements in foreign exchange rates. It is measured in MYR per unit of a basket of foreign currencies. This index is available at Datastream and compiled by JP Morgan and it comprised on broad set of foreign currencies. The index encompasses 64 currencies including US Dollar, Singapore Dollar, Australian Dollar, Sterling Pond and Thai Baht that are of top Malaysian trading partners' currencies. Thus, depreciation of the MYR signifies an appreciation of the TWI and vice versa. The use of TWI over bilateral exchange rates has been subject to a greater debate in literature. Zhou and Wang (2013), for example, claims that to measure overall currency strength, the use of TWI is more appropriate than a bilateral exchange rate. They suggest that the TWI could be appropriate to use if it matches with the foreign activity profiles of sampled firms. Several studies in the literature use TWI instead of separate pair of currencies (see, e.g., Allayannis & Ofek, 2001; Bodnar & Gentry, 1993; He & Ng, 1998; Nguyen et al., 2007). In spirit of these studies, this study uses JP Morgan TWI; however, the robustness of the results is also tested by using different bi-lateral exchange rates in relation with firm stock returns and discussed in detail in the next chapter.

The decision of using real exchange rate or nominal exchange rate depends on to what extent both exchange rates are correlated with each other. De Jong et al. (2006), for example, use nominal rates for Dutch firms and argue that, for low

inflation economies, results are less likely to be biased due to strong association between real and nominal exchange rates. Similarly, Atindéhou and Gueyie (2001) and Miller and Reuer (1998a) claim that use of real or nominal exchange rate would have uniform effect on stock returns if the changes between them are highly correlated. Mark (1990) report strong and significant correlation between real and nominal exchange rates for the seven sampled economies. In line with these predications, correlation was tested between nominal and real exchange rates of JP Morgan TWI over the period and both rates are found to be highly correlated[16]. Therefore, the study takes nominal values for the selected index.

- Finally, β_0 is the intercept of the regression equation, β_1 is the coefficient of TWI sensitivity and measures FX rate exposure. It measures the extent to which returns on firm's stock are sensitive to the change in FX rates. Lastly, ε_{it} is the regression residual for the *i*th firm in period *t.*

3.3.2 Stage-two Model: Determinants of FCDs

This study employs logistic regression model for determining factors that induce Malaysian firms towards the use of FCDs. The use of FCDs is taken as a dependent binary variable whereas other variables are used as explanatory variables in the model. Econometric form of the model is specified as follows:

$$FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^{D} + \alpha_2 RMC_{it} + \alpha_3 CAPEX_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it} \quad \textit{(Equation 3.2)}$$

[16] Pearson correlation between real and nominal exchange rates is 0.810 highly significant at 0.01 level.

where for each *i*th firm and period *t*,

FCD	=	Dummy variable: '1' if firm uses FCDs and '0' otherwise
φ_{it}^{D}	=	Square root of the absolute value of exposure coefficient (β_1) for *i*th firm at time *t* (i.e. $\sqrt{\lvert\beta_{1it}\rvert}$)
RMC	=	Dummy variable: '1' if firm has RMC and '0' otherwise
CAPEX	=	Capital expenditures as a percentage of total sales
MTBV	=	Market value of a firm deflated by book value of a firm
INCOV	=	Earnings before interest and tax scaled by interest expense
LVRG	=	Long-term debt deflated by total assets
SIZE	=	Log of firms' total assets
FSTS	=	Foreign sales as a percentage of total sales
LIQ	=	Current assets of a firm scaled by current liabilities
μ	=	Residual of binary logistic regression model

As earlier discussed, the dependent variable (i.e. FCDs) is a binary variable that equals to '1' if firm *i* reports the use of FCDs in year *t* and '0' otherwise. In literature, logistic model is dominantly used by studies as compared to OLS model while investigating hedging determinants. Studies, who use logistic model, select dummy variable for the use of derivatives in their studies and support this selection with several arguments. Géczy et al. (1997), for example, use binary measurement for currency derivative usage due to the inconsistent or missing information about the magnitude of FX exposure. They argue that, due to the netting and aggregation effect, the disclosures in annual reports are often noisy, that's why they prefer binary variable as a measure of derivative use for their study. Similarly, Lin et al. (2008) find similar results in their study when they use either notional

amount of derivatives traded by sample firms or by using as a dummy variable. Likewise, Allayannis and Ofek (2001) argue that a disadvantage of using notional values is that since firms in some economies are not legally bound to disclose hedging positions, therefore, to identify a long or short positions for FCDs amounts in underlaying currency is become difficult. They also state that, with the exception of few, firms do not disclose the break-down of derivatives amounts by individual currency in their annual reports, so it is difficult to estimate individual currency exposure. Consistent with the arguments of these studies, Malaysian firms neither disclose the direction of hedging contracts nor disclose the break-down of derivative contracts by individual currency, hence, dichotomous measurement of FCDs is more appropriate for analysis in Malaysian context.

In the stage-one model, β_1 refers to the FX exposure of Malaysian firms at daily horizon. β_1 is transformed by taking the absolute value. Although firms negatively or positively exposed to FX rate changes, but this study intent to measure exchange rate exposure in general (irrespective of exposure direction). As taking the absolute values bring truncation bias in a model, therefore, by following Akay and Cifter (2014), Agyei-Ampomah et al. (2013), Bredin and Hyde (2011), Dominguez and Tesar (2006) , Hutson and Laing (2014), Hutson and O'Driscoll (2010) and Hutson and Stevenson (2010) among others, the absolute response coefficient ($|\beta_{1it}|$) is transformed by taking its square-root and denoted by φ_{it}^{D}.

Finally, for the goodness of fit, Hosmer-Lemeshow test is used for stage-two model to check how much the model is well specified. Similarly, Expectation-Prediction test is also

employed on stage-two model to check to what extend FCDs users and nonusers are correctly predicted. Obtained findings from both tests are discussed in next chapter.

3.4 Measurement of Variables

This section provides information about variables used in this study such as variable measurement (proxy) and variables' abbreviation. This information is divided into two tables. Table 3.1 provides information about variables used in stage-one regression model, i.e. estimation of FX rate exposure, in which change in TWI is the explanatory variable, while return on firm's stock is the dependent variable. Similarly, Table 3.2 depicts information about stage-two regression model i.e. determinants of FCDs, in which FCDs used is a dependent variable and FX exposure, RMC, capital expenditure ratio, market-to-book value ratio, interest coverage ratio, leverage ratio, size, foreign sales ratio, and liquidity are taken as explanatory variables. Measurement of some variables are in a ratio form such as leverage ratio, while firms size is measured as log of total assets. As the total asset values are very large (in millions), therefore, log is taken for total asset amount to make the variable values normal. Finally, Datastream mnemonics are also given inside parenthesis in measurement proxy column along with variables.

Table 3.1

Summary of the variables used in stage-one regression model: Estimation of FX rate exposure

Variables	Abbreviations	Measurement Proxy	Study/Reference
Return on firm's stock	R	---	Hutson and Laing (2014), Zhou and Wang (2013)
Trade-weighted Exchange Rate Index	TWI^{JPM}	JP Morgan TWI, Malaysia, Nominal, Broad Basis (MYMGTWNB)	---

Table 3.2

Summary of the variables used in stage-two regression model: determinants of FCDs

Variables	Abbreviations	Measurement Proxy	Study/Reference
FCDs use (dependent variable)	FCD	Dummy Variable: '1' if firm is a FCD user and '0' otherwise	Bartram et al. (2009), Lin et al. (2008), Khumawala et al. (2016)
FX rate exposure	φ_{it}^{D}	FX rate exposure (transformed) estimated from stage-one model	---
Risk Management Committee (RMC)	RMC	Dummy Variable: '1' if firm has RMC and '0' otherwise	---
Capital expenditure ratio	CAPEX	Capital expenditure % Total sales (WC08421)	Bhagawan and Lukose (2014), Shaari et al. (2013)
Market-to-book value ratio	MTBV	$\frac{\text{Market value of a firm}}{\text{Book value of a firm}}$ (MTBV)	Lin et al. (2008), Afza and Alam (2011)
Interest-coverage ratio	INCOV	$\frac{\text{EBIT}}{\text{Interest Expense}}$ (WC08291)	Afza and Alam (2011), Bartram et al. (2009)
Leverage ratio	LVRG	$\frac{\text{Long} - \text{term debt (WC03251)}}{\text{Total Assets (WC02999)}}$	Géczy et al. (1997)
Size	SIZE	Log of firms' total assets (WC02999)	Allayannis and Ofek (2001), Afza and Alam (2011)
Foreign sales ratio	FSTS	Foreign sales % Total sales (WC08731)	Ameer (2010), Lin et al. (2008)
Liquidity	LIQ	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$ (WC08106)	Shaari et al. (2013), Bartram et al. (2009),

3.5 Period of Study

This study estimates FX rate exposure and the propensity to use FCDs by Malaysian nonfinancial firms listed in Bursa Malaysia over the period of 2008 to 2014. The reasons for confining the study to this period are twofold. First, an adequate information regarding firm's risk management activities, hedging policies and derivative financial instruments are available in annual reports during this period as firms are required to disclose such information under Financial Reporting Standard (FRS) 139.[17] Second, the rate of variation in FX rate of Malaysia is relatively higher in this period (i.e. 2008 – 2014) as compared to earlier years which can be easily observed in Figure 1.2. Therefore, it is more meaningful to measure FX rate exposure for this period as it would be more likely to be higher than other periods.

3.6 Sample Selection and Data Collection

Selecting the right and appropriate sample is an important aspect of any research, especially in determining FX exposure it becomes more important as it significantly affect the results (De Jong et al., 2006). Sample is selected from the population of all firms listed in Bursa Malaysia over the period of 2008 to 2014. Total numbers of listed firms in the Main Market were 806. Since this study is primarily interested in nonfinancial firms, so financial firms are excluded from the sample because their intention of using hedging instruments is quite different from that of nonfinancial firms and most of them are market-makers in derivative

[17] FRS 139 Financial Instruments: Recognition and Measurement

markets (Allayannis & Ofek, 2001; Hentschel & Kothari, 2001; Zhou & Wang, 2013). This criterion excluded 56 financial firms which reduces total sample to 750. Firms that are continuously listed on Malaysian stock exchange over the study period are selected and firms are excluded that were delisted during that period as in Bacha et al. (2012). Following Allayannis and Weston (2001), Bartram, Brown, and Conrad (2011), El-Masry and Abdel-Salam (2007), Muller and Verschoor (2006) and Purnanandam (2008), only those firms are included in the sample that have consecutive historical non-missing data from January 2008 to December 2014. These two filters further reduce sample size by 373. Similarly, elimination due to lack of trading volumes, trading halts, suspensions and other gaps in data left sample size to 314.

Finally, sample is further restricted to only those firms that hold *Ex Ante* FX rate risk indications in their annual reports over the study period. Following Clark and Judge (2008), Géczy et al. (1997), Haushalter (2000), Nguyen and Faff (2003a), Judge (2006a), Graham and Rogers (2002), Bartram (2015), Hu and Wang (2005), Tufano (1996) and Marshall, Kemmitt, and Pinto (2012), following are assumed as the indications of *Ex Ante* FX risk for a firm:

- Reporting foreign sales and foreign income in annual report
- Disclosure of foreign income tax and foreign assets
- Qualitative discussion about cross border transactions like exports, imports and foreign operations in the footnotes of annual report

There are two key advantages of using this criterion. First, this criterion is consistent with the study objectives, i.e. measuring FX exposure and determinants of FCDs. For example, firms, due to international linkages (like foreign sales, income and assets), are likely to have inherent FX exposure as argued by Nguyen and Faff (2003a). Consequently, high FX exposure firms are more likely to use FCDs (Géczy et al., 1997). Second, this criterion facilitates in interpreting a firm decision of low derivatives usage to hedge none of its risks, which is different from not holding hedging positions because of a lack of exposure to hedgeable risks. Thus, after using this criterion the final sample contains 224 firms that posse at least one indication of *Ex Ante* FX risk.

This study uses secondary data that is collected from two sources, Datastream and annual reports. Data, such as stock return, index return, exchange rates, assets and liabilities, is collected from Datastream, whereas data about the use of FCDs by firms and the existence of RMC is manually collected from the information given in footnotes of audited annual reports. Annual reports of sample firms are retrieved from Bursa Malaysia website over the period of 2008 to 2014.

3.7 Outliers

An outlier is a case with such an extreme value that it distorts statistics (Tabachnick, Fidell, & Osterlind, 2001). Outliers lead to errors, which consequently deny the generalizability of the results to another sample. Tabachnick et al. (2001) says that there are several reasons of having outliers in dataset such as incorrect data entry and existence of extreme values outside the population of the study.

Data of the current study is highly affected by outliers; therefore, this study employ winsorization method on dataset to mitigate the effect of extreme values. Winsorization is a process in which data is transformed and extreme values are limited in order to mitigate the influence of possible outliers (Howell, 2016). The reasons of giving preference to winsorization over other methods are threefold. Firstly, winsorized parameters are normally more robust as compared to their standard form (Lind, Marchal, & Wathen, 2012). Secondly, winsorizing deemed better than trimming or truncation (an alternate method of dealing with outliers) in which outliers are discarded from the dataset, while in winsorizing, the outlier values are replaced by some percentiles. Finally, several studies on FX exposure and risk management use winsorization method to mitigate the impact of outliers on their dataset (see Chaieb & Mazzotta, 2013; Chen & King, 2014; Choi et al., 2013; Lievenbrück & Schmid, 2014; Manchiraju, Pierce, & Sridharan, 2014; Panaretou, 2013; Purnanandam, 2008 among others). Due to these reasons, data of this study is winsorized at the 5th and 95th percentiles (5% from both tails) to restrict the impact of outliers, and all subsequent analysis is carried out by using winsorized data.

3.8 Conclusion

This chapter starts from the research framework given for both empirical models. Subsequently, hypotheses are developed for the study and measurement of each variable is explained with literature justification. Afterwards, models of the study are depicted along with the definition of variables. In next section, period of the study is mentioned along with the rationales behind selecting time span. Data is collected over the period of 2008 to 2014. And finally, sample selection procedure is described followed by data collection

techniques. Nonfinancial firms are selected for this study listed in Malaysian stock exchange. Data is collected from annual reports and from Datastream. Discussion on results is given in next chapter.

Chapter 4 RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the results of empirical analysis and discusses the findings of the study. The results are first presented for the first model estimating FX exposure of Malaysian firms from 2008 to 2014 and the obtained results are compared with those of previous studies. Afterwards, results are presented for second model in which determinants of FCDs use are discussed. Univariate analysis and correlation analysis are given followed by regression analysis. Finally, robustness of the results is tested by checking the sensitivity of firm's size in stage-two model, taking dichotomous measurement of FX rate exposure coefficient, sensitivity of market portfolio index in exposure model, sensitivity of exposure to different time horizons, sensitivity across different bilateral exchange rates and by using different alternative empirical measures for different explanatory variables.

4.1 Results Analysis: Stage-one Model

This section provides the summary and discussion of the results obtained from stage-one model in which daily stock returns of 224 Malaysian firms are annually regressed against TWI over the period of 2008 to 2014. TWI is the JP Morgan Trade-Weighted Exchange Rate Index used as a proxy of exchange rate changes. It is measured in MYR per unit of a basket of foreign currencies. β_1 (the coefficient of TWI)[18] represents FX exposure measure

[18] β_1 would be subsequently referred and interchangeably used as FX exposure, currency exposure or exposure to exchange rate.

because it describes the sensitivity of stock returns to unexpected movements in foreign currency exchange rate (Muller & Verschoor, 2006). Following subsections provide discussion about the descriptive statistics, direction and significance of β_1 at different levels of significance.

4.1.1 Descriptive Statistics

Table 4.1 reports descriptive statistics of β_1. Some notable facts can be observed here. The mean value, for example, of β_1 ranges from 0.4650 to 0.8705 which implies that mean values of β_1 are not considerably high in any of the year. Furthermore, average β_1 for all sample firms remain positive in all years. Most notably, the high exposure is found in 2014 when mean β_1 is maximum at 0.8705 indicating that, on average, Malaysian firms gain 0.8705% in firm value in case of MYR depreciates by 1%. The minimum and maximum β_1 in 2014 are -1.9394 and 4.2351 respectively. In addition to that, high exposure years for Malaysian firms are 2014, 2011 and 2009 when mean values of β_1 are slightly different from each other in these years with a value of 0.8705, 0.8635 and 0.8325, respectively. Quite the opposite, the lowest average value β_1 is 0.4650 found in 2013 which implies that, on average, value of Malaysian firms rises by 0.4650% if MYR depreciates by 1%. The lowest and highest value of β_1 in 2013 was -1.2483 and 2.1176 respectively. It is interesting to note that the standard deviation of the MYR against a basket of foreign currencies is higher in 2008 and 2009 as compared to other years which is most likely due to Asian Financial Crises, whereas, it is lowest in 2013.

Table 4.1
Descriptive statistics of β_1

Years	Mean	Median	S.D.	Minimum	Maximum
2008	0.5712	0.4832	0.9342	-3.5110	4.0350
2009	0.8325	0.7574	1.3366	-4.5590	6.6546
2010	0.5912	0.5445	0.6796	-2.1685	2.5352
2011	0.8635	0.7858	0.8389	-2.5896	4.1975
2012	0.5591	0.5535	0.7264	-3.6557	2.7302
2013	0.4650	0.4138	0.5336	-1.2483	2.1176
2014	0.8705	0.7186	0.8107	-1.9394	4.2351

This table shows the descriptive statistics of β_1 used in stage-one model which is used to estimate the FX rate exposure of 224 nonfinancial Malaysian firms over the period of 2008 to 2014. The stage-one model is: $R_{it} = \beta_0 + \beta_1 TWI_t^{JPM} + \varepsilon_{it}$; where R_{it} refers to the return rate on *i*th firm's security in time *t*; TWI_t^{JPM} is the JP Morgan TWI used as a proxy of exchange rate changes and measured in MYR per unit of a basket of foreign currencies; β_0 is the intercept of the regression equation; β_1 is the coefficient of TWI refers to FX exposure; and lastly, ε_{it} is the regression residual for the *i*th firm in period *t*.

4.1.2 Magnitude and Significance of β_1 at Different Significance Levels

Table 4.2 represents the direction of FX exposure in terms of positive (greater than zero) and negative (less than zero) signs of β_1. Clearly, the decision about a firm whether it is a net-exporter or net-importer is based on a direction and magnitude of FX exposure (Bacha et al., 2012). For example, exporting goods of a firm become more expensive in international market by the appreciation of Ringgit against TWI and, in result, foreign demand of exporting goods would be reduced which leads to a fall in foreign sales revenue of Malaysian exporting firms. Similarly, a depreciation of the Ringgit against TWI makes exporting goods cheaper in international market, and this may increase foreign demand of

exports and, consequently, rise in foreign sales revenue of Malaysian exporting firms. Therefore, the β_1 should be positive for net-exporters.

Conversely, the importing firm gets advantage from an appreciation of Ringgit against TWI, as its importing products become cheaper in terms of Ringgit and, ultimately, its imports will go up. Similarly, depreciation of the Ringgit will adversely affect importing firms as its imports become expensive in terms of Ringgit and, consequently, reduces the demand of imports. Thus, the β_1 should be negative for net-importers.

It is evident from the Table 4.2 that firms with positive β_1 are more than quadruple from those of negative β_1 over the study period as shown in Figure 4.1. However, the change between the number of positive and negative β_1 across years is negligible which indicates that positive and negative β_1 are evenly distributed over the study period. The dominance of Malaysian firms with positive β_1 in each year implies that most of the Malaysian firms in the sample are net-exporters. Out of 1568 firm-year observations, 1337 (85%) are net-exporters while the rest are net-importers over the study period. Two explanations can be given to support this finding. First, firms' cross-border transactions may involve domestic purchases and production, which ultimately leads them towards positive margins in net export result. Second, several firms that are listed in Malaysian stock exchange are larger in size and Malaysian domestic market is too small for them. Therefore, these firms are more likely to engage in overseas transactions; hence, more likely to be net exporter.

Table 4.2
Direction and significance of β_1 at different levels of significance

Years	$\beta_1 < 0$	$\beta_1 > 0$	Total Number of Firms	Significance of β_1 at different levels		
				1% (+ve, -ve)	5% (+ve, -ve)	10% (+ve, -ve)
2008	42	182	224	30 (13%) (30, 0)	61 (27%) (59, 2)	79 (35%) (76, 3)
2009	40	184	224	39 (17%) (38, 1)	76 (34%) (74, 2)	104 (46%) (100, 4)
2010	32	192	224	60 (27%) (60, 0)	93 (42%) (92, 1)	111 (50%) (110, 1)
2011	23	201	224	83 (37%) (83, 0)	112 (50%) (112, 0)	136 (61%) (135, 1)
2012	38	186	224	29 (13%) (29, 0)	71 (32%) (70, 1)	98 (44%) (94, 4)
2013	38	186	224	43 (19%) (43, 0)	79 (35%) (79, 0)	100 (45%) (100, 0)
2014	18	206	224	50 (22%) (50, 0)	94 (42%) (94, 0)	117 (52%) (115, 2)
Total*	**231 (14%)**	**1337 (85%)**	**1568**	**334 (21%)**	**586 (37%)**	**745 (48%)**

* Total percentages are out of 1568 firm-year observations

This table shows the direction (column 2 and 3) and significance of β_1 at 1%, 5% and 10% level of significance (last three columns) estimated from stage-one model which is used to estimate the FX rate exposure of 224 nonfinancial Malaysian firms over the period of 2008 to 2014. The stage-one model is: $R_{it} = \beta_0 + \beta_1 TWI_t^{JPM} + \acute{\varepsilon}_{it}$; where R_{it} refers to the return rate on *i*th firm's security in time t*;* TWI_t^{JPM} is the JP Morgan TWI used as a proxy of exchange rate changes and measured in MYR per unit of a basket of foreign currencies; β_0 is the intercept of the regression equation; β_1 is the coefficient of TWI refers to FX exposure; and lastly, $\acute{\varepsilon}_{it}$ is the regression residual for the *i*th firm in period *t.*

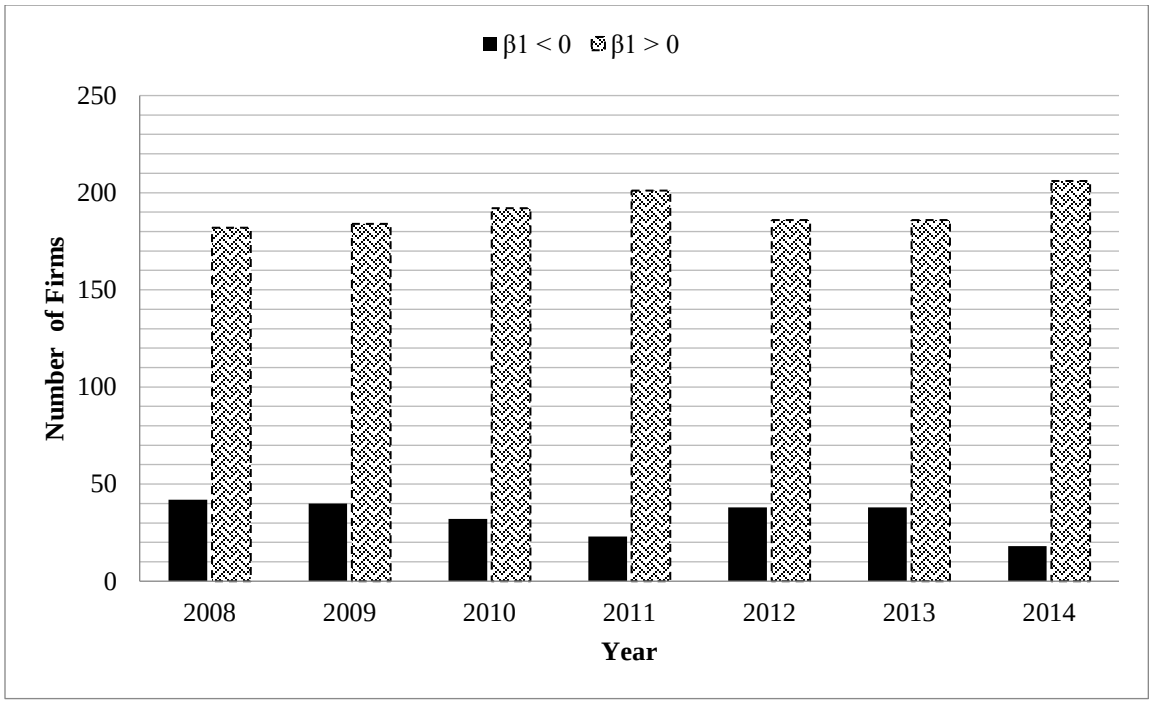

Figure 4.1
Annual distribution of positive and negative β_1 over the study period

Table 4.2 also demonstrates the significance of β_1 at different levels of significance. Overall, 48%, 37% and 21% of Malaysian firms having significant β_1 at 10%, 5% and 1% level respectively over the period. The FX exposure continuously increases between 2008 and 2011 but afterwards decline. In 2011, the FX exposure reaches its maximum level when 136 (61%) firms are significantly exposed to exchange rate changes at 10% level as compared to other years. On the contrary, 2008 is a favorable year for Malaysian firms when the least number of firms is exposed to FX risk. These results confirm first hypothesis (H_1) that volatilities in exchange rates affect stock prices of Malaysian firms and firms are facing high FX rate exposure.

If these results are compared with previous studies, it can be concluded that Malaysian firms are more exposed to the changes in exchange rate. For instance, Pritamani et al. (2004) find only 4% of the US firms are negatively exposed to FX rate changes. Similarly, findings of Bodnar and Wong (2003) reveal that 15% of the 910 US firms are significantly exposed to exchange rate changes at 1-18 month return horizon. Likewise, Parsley and Popper (2006) conduct their study on eleven Asia-Pacific countries including Malaysia. In general, their results exhibit that 49% of all sampled firms are significantly exposed to fluctuations in USD, while for Malaysian firms, 65% and 37% are significantly exposed to USD and Japanese Yen, respectively. Similarly, Du et al. (2014) estimate total exposure for 815 Taiwanese public listed firms as well as self-constructed twenty-five stock portfolios and find that 90% of sample firms have significant total exposure while all stock portfolios are significantly exposed to exchange rate changes. In a similar study, using deciles and sector portfolios, Koutmos and Martin (2007) find that total exposure is positive and statistically significant for the deciles and sector portfolios. Likewise, Priestley and Ødegaard (2002) estimate exposure of eight industry indices of Norway and find that all Norwegian industrial sectors are significantly and negatively exposed to the European Currency Unit (ECU) and positively exposed to USD.

As far as the direction of exposure is concerned, findings of previous studies are mixed. For example, Muller and Verschoor (2006) report that, out of 3634 Asian firms[19], 121 and 786 are positively and negatively exposed to USD respectively and 128 and 679 firms are positively and negatively exposed to Japanese Yen respectively. Similarly, Nguyen and

[19] Philippines, Indonesia, Thailand, South Korea, Hong Kong, Malaysia and Singapore

Faff (2003a) find 78 positive and 66 negative significant exposure coefficients from the sample of 144 Australian firms. From a sample of 409 US firms, Choi and Prasad (1995) exhibit 39 significantly positive versus 22 significantly negative exposure coefficients. Likewise, Nydahl (1999) finds that, out of 47 Swedish sampled firms, six firms negatively and six firms positively exposed to exchange rate changes. From a sample of 171 Japanese firms, He and Ng (1998) study show 43 positive and two negative exposure coefficients. Nevertheless, the results of this study are in line with De Jong et al. (2006) who report all significant positive exposure coefficients for Dutch firms. This study also reports that, on average, Malaysian firms are positively exposed to the changes in exchange rate in all years indicating that firms get benefit from a depreciation of the MYR. Taken as a whole, the results, obtained from stage-one model, corroborate study conjecture that in open and developing economies, like Malaysia, firms exhibit more exposure to FX rate changes as compared with developed or closed economies, such as the Australia, US or UK.

4.2 Results Analysis: Stage-two Model

This section presents the results of stage-two model which examines the propensity of Malaysian firms towards the use of FCDs. The regression employs a binary measure for the use of FCDs. Firms that use derivative instruments to hedge currency risk is assigned a value of '1' and '0' otherwise. As the dependent variable is of dichotomous nature, this study estimates the parameters of logistic regression model to examine the factors that influence the use of FCDs by Malaysian firms. In regression model, the binary dependent variable is regressed on explanatory variables that are proxy of different corporate hedging theories such as underinvestment cost and costs of financial distress.

4.2.1 Descriptive Statistics

Table 4.3 depicts some descriptive statistics of explanatory variables of stage-two model. φ^D, obtained from stage-one model, refers to daily FX exposure of Malaysian firms and transformed by taking square-root of its absolute values[20]. The minimum value of the coefficient of φ^D is 0.03 while the maximum is 2.58. Results reveal the mean and median value of 0.8336 and 0.8046 respectively. The standard deviation is predicted to be 0.37459 for φ^D. Finally, first and third quartiles are 0.5687 and 1.0699 respectively.

RMC measured as a dummy variable having a value of '1' if a firm has a separate risk management committee responsible to formulate and implement risk management policies and mitigate the level of firm's risk. The mean value of RMC is 0.4171 with a standard deviation of 0.4932.

To test underinvestment theory, capital expenditure ratio (CAPEX) and market-to-book value ratio (MTBV) are used in this study by following Bartram et al. (2009), Bhagawan and Lukose (2014), Lin et al. (2008) and Géczy et al. (1997) among others. Mean, median and standard deviation of CAPEX are 4.9077, 3.5700 and 4.09968 respectively. If these results are compared with Ameer (2010), who also conduct his study on Malaysia over the period of 2003 to 2007, mean and median values of 16.41 and 5.50 respectively are surprisingly higher than that of the current study. This difference may be due to difference in sample periods which signifies that Malaysian firms are having more growth and

[20] See Section 3.3.2 for detailed discussion about transformation of daily FX exposure coefficient.

investment opportunities in the period of 2003 to 2007; but afterwards these opportunities become reduced possibly due to Asian financial crises. Likewise, surprisingly high average CAPEX value 22.92 is reported by Sprcic and Sevic (2012) for Croatian and Slovenian companies for the year 2005. Close to the current study values, Graham and Rogers (2000) report mean CAPEX value of 6.13 for US firms. Finally, the first and third quartiles for CAPEX are 2.0700 and 6.4650 respectively

Similarly, for the second proxy of underinvestment theory, strikingly high average MTBV 4.68 is reported by Nguyen and Faff (2010) for Australian firms and 5.4971 reported by Chaudhry, Iqbal, Mehmood, and Mehmood (2014) for Pakistani firms as compared to current study average value of 0.9471. Likewise, Lievenbrück and Schmid (2014) report 2.17 mean MTBV for worldwide energy utilities. Finally, the first and third quartiles for MTBV are 0.5900 and 1.1800 respectively with the standard deviation value of 0.53402.

Results reveal that average interest coverage ratio (INCOV) is 11.0768 with the minimum of -25.84 and maximum of 39.37. Mean value shows that, on average, Malaysian firms' earnings are 11 times higher than their interest expense. Results of Berkman et al. (2002) demonstrate that industrial firms of Australia are facing more financial distress situation than Malaysian firms with the mean and median interest values of 1.97 and 1.91 respectively. Howton and Perfect (1998) report higher mean interest coverage value of 32.41 for US firms as these firms are larger in size and more profitable, hence, more likely to cover their interest expense with their earnings. However, their data have more dispersion with standard deviation value of 115.64 as compared to current study value of 14.89. Finally, first and third quartiles of INCOV are 2.0404 and 21.2221 respectively.

Table 4.3
Descriptive statistics of explanatory variables of stage-two model

Predictor	Mean	Minimum	Q1	Median	Q3	Maximum	Std. Dev.
φ^D	0.8336	0.03	0.5687	0.8046	1.0699	2.58	0.37459
RMC	0.4171	0.000	0.0000	0.0000	1.0000	1.00	0.4932
CAPEX (%)	4.9077	0.000	2.0700	3.5700	6.4650	17.31	4.09968
MTBV	0.9471	-0.61	0.5900	0.8100	1.1800	2.81	0.53402
INCOV	11.0768	-25.84	2.0404	5.9330	21.2221	39.37	14.88701
LVRG	0.0556	0.000	0.0145	0.0293	0.0932	0.19	0.05460
Total Assets ('000)	424,684	2,597	138,264	294,431	821,814	934,137	335,899
SIZE	19.7149	14.77	18.7447	19.5	20.527	24.83	1.569
FSTS (%)	28.8178	0.000	8.3840	23.1310	44.2200	110.04	25.08500
LIQ	2.3813	0.000	1.4125	1.9941	2.8630	6.55	1.39738

This table presents the descriptive statistics of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^D + \alpha_2 RMC_{it} + \alpha_3 CAPEX_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; Total assets amounts are shown in thousands; Total assets amounts are shown in thousands; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

Mean and median values of leverage (LVRG) are 0.0556 and 0.0293 respectively that are almost similar with Ameer (2010) who reports a mean of 0.0953 and a median of 0.0572 for Malaysian firms from year 2003 to 2007. This shows that no significant change arises in financial leverage level of Malaysian firms from 2003 to 2014. Choi et al. (2013) and

Howton and Perfect (1998) report slightly higher mean and median values of leverage ratio for US firms than those of the current study. Former report 0.207 and 0.170 values while later report 0.30 and 0.26 values for mean and median respectively. Berkman et al. (2002) report mean leverage value of 0.21 closer to these two studies. Likewise, Chaudhry et al. (2014) report 0.5583 relatively higher mean leverage value for Pakistani firms. Similarly, mean LVRG value of current study is lower than 0.27 reported by Bodnar, Giambona, Graham, and Harvey (2016) for American and European firms and 0.218 reported by Nguyen and Faff (2010) for Australian firms, indicating that these developed countries firms are more leveraged than Malaysian firms. LVRG is maximum at 0.19 which is significantly lower than maximum value of 1.337 reported by Choi et al. (2013); however, the dispersion in their leverage data is 0.200 which is higher than current study, i.e., 0.05460. First and third quartiles for LVRG are 0.0145 and 0.0932 respectively.

The maximum and minimum values of size (SIZE) are 24.83 and 14.77 respectively with the mean value of 19.7149. Finally, first and third quartiles of SIZE are 18.7447 and 20.527 respectively with the standard deviation of 1.569. Similarly, the average foreign sales ratio (FSTS) is 28.8178 which is higher than 19.99 reported by Lin et al. (2008) for Fortune 500 firms. First and third quartiles are 8.3840 and 44.2200 respectively with the median of 23.1310. Finally, average liquidity ratio (LIQ) is 2.3813 which is higher than 1.91 reported by Jalilvand (1999) for Canadian firms. Nguyen and Faff (2010) and Howton and Perfect (1998) report almost similar average liquidity ratios with 2.54 and 2.13 respectively, while Berkman et al. (2002) report relatively lower mean liquidity ratio of 0.71 for Australian firms. Highest LIQ is recoded as 6.55 whereas first and third quartiles are 1.4125 and 2.8630 respectively.

4.2.2 Univariate Analysis

In order to make comparison between operating characteristics of Malaysian firms, sample is further divided into two sub-groups. First group consist of those firms that consider corporate hedging through derivatives is a value enhancing tool. This group is classified as FCDs *users*. Second group comprised of those firms who does not consider derivative instruments' usage as a valuable activity. This group is classified as *non-user* of FCDs. Table 4.4 shows the differences between means of different explanatory variables with respect to FCDs users and non-users. Total firm-year users and non-user observations are 483 and 1085 respectively. In addition to that, following Sprcic and Sevic (2012), Graham and Rogers (2000), Bashir, Sultan, and Jghef (2013), Wang and Fan (2011) and Clark and Judge (2008) among others, *t*-statistics is used to identify whether or not the users and non-users of derivative financial instruments are significantly differ from each other in terms of their characteristics.

As stated earlier, φ^D, obtained from stage-one model, refers to FX exposure of Malaysian firms and transformed by taking square-root of its absolute values. Results show that, on average, non-users are characterized as high exposure firms while derivative users are characterized as low exposure firms which is inconsistent with the hedging theory. It can be seen from the table that non-users of FCDs are found to be having more FX exposure with the average value of 0.8573, while users of FCDs report a mean value of 0.7882. The likelihood of using derivative financial instruments should be associated with those firms that are facing high exposure than non-users but here, results run counter to this hedging

hypothesis. The mean difference test shows that users and non-users regarding FX exposure are statistically and significantly different from each other.

The existence of RMC in a firm signifies that firm has adequate financial and human resources to counter several types of risks together with foreign currency risk. Univariate analysis reveals higher mean value of RMC for users as compared to non-users. Users report a mean value of 0.4969 as compared to 0.3816 for non-users which is in line with the notion firms having RMC are in a better position (than firms without RMC) to involve in derivative transactions due to trained personnel and staff and separate risk management mechanism.

CAPEX and MTBV are used as a proxy to test underinvestment theory which states that firms may face underinvestment problem and forego opportunities to invest in positive NPV projects due to shortage of internal financing and liquidity problem; and these can be alleviated by adopting effective risk management strategies and the use of hedging instruments (Froot et al., 1993). The univariate results explain that users have higher CAPEX with an average value of 5.307 than non-users. Similarly, users show high growth opportunities (MTBV) having a mean value of 1.0199 which is higher than a mean value of non-users of 0.9147. The mean difference test for both underinvestment proxies shows that users and non-users are statistically and significantly different from each other. Both results (i.e. CAPEX & MTBV) are consistent with the underinvestment theory that users with high growth and investment opportunities can reduce their cash flow volatilities by the means of hedging. This will smooth their cash flows by reduce cash flow volatilities

and enable them to utilize optimal growth opportunities by investing in profitable projects which ultimately enable them to avoid high cost of external financing.

Table 4.4
Difference between means of explanatory variables with respect to users and non-users of FCDs

Variables	Mean		*t-statistics* (for the differences between means of users & non-users of FCDs)^
	Non-users (n=1085)	Users (n=483)	
φ^D	0.8537	0.7882	3.3860 (0.0010)***
RMC	0.3816	0.4969	-4.250 (0.0000)***
CAPEX (%)	4.730	5.307	-2.5730 (0.0100)***
MTBV	0.9147	1.0199	-3.4870 (0.0010)***
INCOV	10.575	12.204	-2.1270 (0.0340)**
LVRG	0.05046	0.06727	-5.4510 (0.0000)***
SIZE	19.2214	19.8808	-12.946 (0.0000)***
FSTS (%)	26.206	34.68	-6.1400 (0.0000)***
LIQ	2.4562	2.213	3.4030 (0.0010)***

*** significant at 1%, ** significant at 5%, * significant at 10% ^All figures in parenthesis are *p*-values.

This table presents the differences between means among all explanatory variables with respect to FCDs users and non-users. For this purpose, T-statistics is employed which indicates whether FCDs users and non-users are statistically different from each other in terms of their characteristics. φ^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a binary variable with a value of '0' if firm do not have RMC and '1' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; and finally, LIQ is measured as current assets of a firm scaled by current liabilities.

To test the theory of financial distress cost, INCOV and LVRG are used as a proxy. The higher a firm's long-term debt ratio and the lower its coverage ratio, the higher the likelihood of financial distress. High leverage ratio indicates that the firm is facing high financial distress, which is a dangerous situation not only for firms rather for all stakeholders, which ultimately could lead them towards bankruptcy. Therefore, the higher a firm's long-term debt ratio and the lower its coverage ratio, the greater the probability of using FCDs, *ceteris paribus* (Géczy et al., 1997).

The findings of previous studies regarding financial distress proxies are mixed. The average INCOV for non-users is 10.575 is lower than users with a value of 12.204. These figures are inconsistent with the theory that implies that non-users have high burden of finance cost on their outstanding debt as compared to users that are categorized as low-debt firms and are able to pay their debt cost. There can be two possible justification of this finding. First, low INCOV indicates that firms have low interest cost; hence facing lower interest rate exposure. But these firms might have high exposure to FX rate; hence are more induce towards foreign currency hedging. Second, high INVOC for nonusers indicates that they may have adequate financial resources, cash and cash equivalents and better liquidity position to pay their finance cost. Therefore, due to strong financial position, they are able to engage in FCDs transaction to hedge their FX rate risk. Finally, results of univariate analysis discover that non-users and users in terms of INCOV are statistically and significantly different from each other.

On the other side, LVRG, the ability of a firm to meet its financial obligations, is high for the users with the mean value of 0.06727 as compared to non-users. This result is aligned

with the theory of financial distress as high leverage firms are more induced towards hedging and have more incentive from hedging than low leverage firms. Result of mean difference test shows that non-users and users of derivative financial instruments are significantly different from each other in terms of LVRG.

To test the size hypothesis, a proxy of log of total assets (SIZE) is used. It is evident from the table that users of FCDs are identified as large size firms with a value of 19.8808 as compared to non-users that document an average size of 19.2214. These figures are consistent with the hypothesis that derivative users have more specialized resources, trained staff to effectively implement hedging programs and use hedging instruments, hence they are more likely to hedge their financial risk. On the opposite, small size firms have inadequate resources and lack of skilled personnel to set up hedging programs and unable to bear its operational costs. Therefore, they are less likely to hedge. Mean difference test reveals that both groups of FCDs statistically and significantly different from each other in terms of SIZE.

Results of univariate analysis are coherent with the hypothesis that firm's need to use FCDs is directly proportional to its foreign sale level as shown in Table 4.4. Users exhibit high FSTS with a mean value of 34.68 indicating these firms are more involve in cross-border trade; hence, more likely to face FX risk and, in result, more likely to use derivatives. Conversely, non-users demonstrate, with the average value of 26.206, that they are comparatively lesser engaged in international transactions and likely to face low currency exposure, therefore, not much induce towards hedging. The value of *t*-statistics shows that

both non-users and users are statistically and significantly different from each other in terms of FSTS.

It is predicted by the theory that firm's incentive to hedge with derivatives can also be influenced by its liquidity. Mean differences of LIQ between users and non-users conforms this conjecture. Users of FCDs are recognized as liquidity constrained firms with the average value of 2.2130 as compared to non-users, having an average value of 2.4562. This implies that the non-users with more liquid assets have less incentive to engage in risk management, since it is secured by sufficient funds to repay its debts. In opposition, users are facing liquidity constraints and, consequently, might have less ability to pay to stockholders and creditors; hence, more inclined towards the use of derivative instruments. Finally, mean difference test demonstrates statistically significant difference between LIQ of both the groups.

4.2.3 Correlation Analysis

Pearson's correlation is employed for the purpose of measuring the degree of relationship among explanatory variables. Correlation results between the explanatory variables of stage-two model are illustrated in Table 4.5. It is evident from the table that none of the correlation coefficient is greater than 0.8 or 0.9 which might lead to the problem of multicollinearity (Gujarati & Porter, 2009). The largest correlation coefficient is 0.360 between SIZE and LVRG which is less than 0.9. Similarly, the smallest correlation coefficient is – 0.008 between RMC and φ^D .

Table 4.5
Correlation matrix between explanatory variables

	φ^D	RMC	CAPEX (%)	MTBV	INCOV	LVRG	SIZE	FSTS (%)	LIQ
φ^D	1								
RMC	-0.008	1							
CAPEX (%)	-0.058*	.040	1						
MTBV	-0.030	0.136**	0.107**	1					
INCOV	-0.144**	0.059*	-0.018	0.076**	1				
LVRG	0.047	0.119**	0.217**	0.011	-0.244**	1			
SIZE	-0.032	0.259**	0.241**	0.183**	0.090**	0.360**	1		
FSTS (%)	-0.013	-0.028	0.012	0.017	-0.014	-0.008	0.201**	1	
LIQ	-0.118**	-0.024	-0.059*	-0.019	0.200**	-0.294**	-0.196**	-0.099**	1

* Correlation is significant at the 0.05 level ** Correlation is significant at the 0.01 level

This table measures the degree of relationship between explanatory variables used in stage-two regression model. φ^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; and finally, LIQ is measured as current assets of a firm scaled by current liabilities.

High correlation between explanatory variables leads towards the multicollinearity issue and causes a problem to the regression model by making it difficult to identify the impact of each explanatory variable on a dependent variable (Berkman & Bradbury, 1996). Therefore, multicollinearity issue is tested between explanatory variables of stage-two model. The general rule implies that there would be a strong linear association between two explanatory variables if their correlation coefficient is greater than 0.8 (Panaretou, 2013). The highest correlation coefficient is found 0.360, indicating no severe collinearity

problem in regression model. However, the multicollinearity is formally tested through variance inflation factor (VIF) among all explanatory variables. The VIF is developed by Belsley, Kuh, and Welsch (1980) and extensively used in empirical literature to measure multicollinearity between variables. Variables are considered to be highly collinear if their VIF values are greater than 10 (Tu, Kellett, Clerehugh, & Gilthorpe, 2005).

Table 4.6
Multicollinearity test for all explanatory variables by using VIF

Explanatory variables	**Variance Inflation Factor (VIF)**
φ^D	1.036
RMC	1.094
CAPEX (%)	1.097
MTBV	1.057
INCOV	1.157
LVRG	1.358
SIZE	1.421
FSTS (%)	1.068
LIQ	1.155

This table exhibits VIF values of all explanatory variables used in stage-two model in order to check multicollinearity. φ^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; and finally, LIQ is measured as current assets of a firm scaled by current liabilities.

Table 4.6 demonstrates VIF value for each explanatory variable used in stage-two model. As the highest value of VIF is 1.421, which is lower than 10, thus, there is no severe

multicollinearity issue between variables. The VIF values confirm the results of correlation analysis presented in the previous section.

4.2.4 Results and Discussion

As the tests on mean differences only provide insights into the unconditional relationships between firm characteristics and hedging (Fok, Carroll, & Chiou, 1997), therefore, logistic regression is employed to examine the conditional relationships between them. Logistic regression tests different corporate hedging theories proxied by different explanatory variables and estimates the propensity of Malaysian firms towards using derivative instruments. The results obtained from fitting the logistic regression model (stage-two model) are presented in Table 4.7. The table reports the estimated coefficient and significance *(p-value)* of each explanatory variable followed by their odds ratios.

Results reveal that φ^D is highly and statistically significant and negatively associated with hedging (α_1 = -0.528, *p*-value < 0.01). This rejects H_2 which states that FX rate exposure and FCDs use are positively related with each other. Odds ratio indicates that one unit increase in φ^D decreases the likelihood of using FCDs by 0.528 times. This finding is in contrast with the exposure conjecture which states that increase in currency exposure leads to the increase in FCDs use.

There can be several justifications of negative relationship between the use of FCDs and φ^D. Malaysian firms, for example, may employ non-derivative hedging techniques to avoid financial risk instead of using FCDs. Similarly, during the periods of uncertainty,

firms sometimes prefer natural hedging techniques in order to manage their FX risk (Arterian, 1993; Chowdhry & Howe, 1999). Firms, for instance, may use foreign currency debt to mitigate their FX risk which acts as a natural hedge for foreign revenues and receipts (Judge, 2006b). In relation to foreign currency debt, several studies (see Allayannis & Ofek, 2001; Elliott, Huffman, & Makar, 2003; Géczy et al., 1997; Graham & Rogers, 2002 among others) argue that the use of foreign currency debt is an adequate substitute of derivative financial instruments in hedging FX exposure.

Similarly, Malaysian firms may use operational hedging techniques to reduce their currency exposure in lieu of using FCDs. Firms, for example, may opt *matching currency cash flows* method to offset their FX exposure by making export invoices in foreign currency and acquiring debt denominated in same foreign currency after matching their cash inflows and outflows, so that cash inflows generated against export transactions can be used for debt payment (Eiteman, Stonehill, & Moffett, 2007). Likewise, as an alternative arrangement of managing FX exposure, Malaysian firms may engage themselves in *parallel loans* or *credit swaps* transactions with another firm (in different country) by borrowing each other's currency for a specific period of time. In a same way, firms may use off-balance sheet techniques to reduce their currency exposure, like *currency swaps* where the amount of one currency against different currency is swapped between two firms, and after specified time period, firms returned back the original swapped amount. Similarly, Malaysian firms may engage in internal hedging techniques, as a replacement of derivative instruments, to reduce their exposure through *leading and lagging* technique in which firms pay early or pay late, respectively, the outstanding amounts of payments in FX transaction because of unanticipated changes in FX rates.

Finally, other risk mitigating techniques, in place of financial hedging techniques, may employed by Malaysian firms. *Risk-sharing agreements*, for example, may be used by firms to alleviate financial risk through binding themselves in a contractual agreement with another party to share exposure between them. Similarly, a *re-invoicing centers* may be set up by firms to mitigate their currency exposure as an alternative means of hedging in which a separate corporate subsidiary is established (works as a middleman) between all foreign subsidiaries in a specific geographic location. In summary, with the increase in FX exposure, firm's use of FCDs may reduce if firms engage themselves in aforesaid alternative hedging techniques.

Table 4.7
Results summary of explanatory variables of stage-two model

Predictor	**Coefficient Estimate**	***P-value***	**Odds Ratios**	**Std. Error**
Constant	-8.116	0.0000***	0.000	0.806
φ^D	-0.528	0.0020***	0.590	0.170
RMC	0.138	0.2600	1.148	0.122
CAPEX (%)	-0.004	0.7990	0.996	0.015
MTBV	0.120	0.2860	1.127	0.112
INCOV	0.008	0.0820*	1.008	0.004
LVRG	3.116	0.0090***	22.558	1.193
SIZE	0.546	0.0000***	1.727	0.063
FSTS (%)	0.010	0.0000***	1.010	0.002
LIQ	-0.014	0.7670	0.986	0.048
Hosmer-Lemeshow Test	*p-value* = 0.517 df = 8			
McFadden R^2	0.2984			
Total observations (N)	224			

Expectation-Prediction Test for Logistic Regression

Predication Evaluation (Success Cutoff = 0.5)	Correct Prediction (%)	Incorrect Predication (%)
FCDs Nonusers	(1,006) 92.7	(79) 7.3
FCDs Users	(125) 25.9	(385) 74.1
Total	**(1,131) 72.1**	**(437) 27.9**

*** significant at 1% ** significant at 5% * significant at 10%

This table presents the result summary (with estimated coefficients, p-values, Odds ratios and standard error) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^D + \alpha_2 RMC_{it} + \alpha_3 CAPEX_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

Hosmer-Lemeshow test and McFadden R^2 are a goodness of fit tests that tell how well data fits the model. Finally, results of Expectation-Prediction test are also given about correct and incorrect predictions about users and nonusers of FCDs.

The second explanatory variable in stage-two regression model is RMC which is found to be insignificant ($\alpha_2 = 0.138$, *p*-value = 0.260); which means that the likelihood of using of FCDs is not explained by RMC. This rejects H_3 which states that there is a positive relation between RMC and the use of FCDs. The presence of RMC does not have any impact on FCDs use by Malaysian firms. Two plausible explanations could be given of insignificant relationship between these two variables. Firstly, responsibility of identifying and managing different types of risks is usually distributed among audit committee (a part of internal control system) and RMC. Both committees seek to ensure the implementation of effective and appropriate control mechanism to manage different kinds of risks like commodity price risk, interest rate risk and foreign exchange risk. Therefore, as the financial and operating risks are adequately encountered and managed by predefined policies and systems through audit committee and RMC, Malaysian firms may not fell additional need to move towards derivative markets for hedging transactions. Secondly, RMC is formulated not only to control and manage foreign currency risk but also different other types of risks such as strategic risk, compliance risk and operational risk. So, it is probable that firms who are facing little or no exchange rate risk, may significantly suffer from other types of risk and RMC is engaged in mitigating those risks. Correspondingly, firms who are facing exchange rate risk, the RMC in those firms may alleviate firm's currency exposure through other natural and operational hedging techniques (as discussed previously) and do not go towards the use of financial derivative instruments.

Two proxies are selected to test underinvestment hypothesis; CAPEX and MTBV. This study finds no support for the underinvestment hypothesis as both are not associated with a higher likelihood of FCDs use. CAPEX is found to be insignificant (α_3 = -0.004, *p*-value = 0.7990) indicating that investment opportunities for Malaysian firms do not have any impact on derivative usage; therefore, H_4 is rejected which signifies towards the existence of relationship between CAPEX and FCDs. This finding is in line with Fauver and Naranjo (2010) who also find insignificant relation between capital expenditure and propensity to use derivatives. Similarly, MTBV is also statistically insignificant (α_1 = 0.120, *p*-value = 0.2860) implying that growth opportunities do not affect firm's hedging pattern; hence H_5 is rejected which suggests the relationship between MTBV and FCDs. This finding is in line with Afza and Alam (2011), Allayannis and Ofek (2001), Géczy et al. (1997), Mian (1996), Nguyen and Faff (2003b) and Rossi Júnior (2007) who also find MTBV insignificant in relation with derivative use.

Financial distress cost theory is tested by two proxies; INCOV and LVRG. Both are found to be significant which indicates that financial distress firms hedge their risk through FCDs. INCOV is found to be significant (α_5 = 0.008, *p*-value < 0.10); hence H_6 accepted which indicates the relationship between INCOV and FCDs. Odds ratio signifies that one unit increase in INCOV increases the probability of using derivatives by 1.008 times. The coefficient of INCOV is observed positive which is inconsistent with the theory. This indicates that Malaysian firms use derivatives even when they are in a good position of paying their fixed cost. This is contrary to the notion that financial distress firms with low ability to cover their interest cost are more likely to incline towards derivative use. A plausible explanation of this finding is that firms with high level of interest cost (and low

interest coverage ratio) are more likely to use *interest rate derivatives* (instead of FCDs) to hedge their interest rate exposure. They might not be facing currency exposure; therefore, they are not using FCDs.

On the other side, LVRG results are in line with the theory that the greater the firm's leverage, the more likely the firm is to use derivatives. Finding reveal that LVRG is positively and significantly (α_6 = 3.116, *p*-value < 0.01) affecting the use of FCDs indicating that highly leveraged firms are more likely to engage in derivative transactions. This accepts H_7 which proposes the relationship between LVRG and FCDs. Odds ratio is amazingly high implying that the likelihood of using FCDs increases by approximately 22 times as LVRG increases by one unit. These results are consistent with Berkman et al. (2002), Choi et al. (2013), Khumawala et al. (2016) and Nguyen and Faff (2002) who also find significant positive relationship between leverage and propensity to use derivatives.

A voluminous literature (Géczy et al., 1997; Graham & Rogers, 2002; Haushalter, 2000; Mian, 1996; Nance et al., 1993) provide evidence that, comparatively, large size firms have a stronger tendency to hedge and in a position to implement and maintain a hedging program. Therefore, size (SIZE), as an explanatory variable, is tested in stage-two model against the use of FCDs by Malaysian firms. Consistent with insights from the corporate sector literature, it is found that the interaction between hedging and firm size captures a large majority of the hedging premium. SIZE is highly significant (α_7 = 0.546, *p*-value < 0.01) with a positive coefficient indicating that level of FCDs usage by Malaysian firms increases with the increase in firm size; while odds ratio exhibits 1.727 times increase in probability of using FCDs with one unit increase in SIZE. This accepts H_8 which assumes

positive relationship between SIZE and FCDs. Results are in line with Berkman et al. (2002), Choi et al. (2013), Fauver and Naranjo (2010), Fok et al. (1997), Khumawala et al. (2016) and Nguyen and Faff (2002) who also observe a strong positive relationship between firm size and the likelihood of FCDs use. However, results of current study about SIZE are generally stronger than those observed in previous studies (such as Afza & Alam, 2011; Allayannis & Ofek, 2001; Ameer, 2010; Bartram et al., 2009; Nguyen & Faff, 2002). The finding also supports the argument of Nance et al. (1993) and Graham and Rogers (2000) that implementing derivatives hedging programs at corporate level require adequate financial resources, large fixed cost and expert personnel, and larger firms have more specialized resources and trained staff to effectively implement hedging policies and use derivative instruments. In contrast, small size firms are less likely to obtain potential advantages to offset these costs, therefore they are less likely to induce towards derivative instruments.

High uncertainty in firm's cash flows due to higher level of foreign business operations and cross-border trade result in greater potential benefits from FCDs use (Afza & Alam, 2011; Géczy et al., 1997). Therefore, the impact of foreign sales (FSTS) on hedging through FCDs is tested in stage-two model. Results demonstrate that Malaysian firms with greater foreign business operations and international business linkages are getting higher hedging incentives. FSTS is highly significant ($\alpha_8 = 0.010$, p-value < 0.01) with positive coefficient representing that firms with high level of foreign trade are likely to face higher level of FX exposure; therefore, more induce to use hedging instruments. This accepts H_9 which suggests the positive relationship between FSTS and FCDs. Odds ratio depicts that one unit increase in FSTS enhance the chances of using derivatives by 1.010 times. The

results are in line with Ameer (2010), Afza and Alam (2011), Choi et al. (2013), Lin et al. (2008) and Géczy et al. (1997) who also find significant direct relation between FSTS and derivative use.

Firms with higher levels of liquidity will lower the likelihood of financial distress as funds will be available to pay debt claims and will have less need to access derivative market for hedging. The extent to which liquidity works as a substitute of hedging for Malaysian firms is tested in empirical regression model by using a proxy, i.e. current ratio (LIQ). Results show that the level of liquidity has no influence on the firm's decision to use derivative to hedge; hence H_{10} is rejected which assumes the relationship between LIQ and FCDs. The result is consistent with the Fok et al. (1997), Géczy et al. (1997), Nguyen and Faff (2002, 2010) and Raghavendra and Velmurugan (2014) who also find insignificant relationship between LIQ and derivatives usage. The failure of the current ratio in explaining FCDs use may reflect an inappropriate empirical proxy. Although, the current ratio is commonly used to measure the ability of a firm to meet short-term financial obligations, however, there is a likelihood that current ratio may not be able to appropriately measure the financial slack of a firm which is generally used for investment purpose, since several items of current assets, such as inventories and debtors, may not be quickly and easily convertible into cash. Therefore, derivatives use is tested by using quick ratio in robustness as an alternate measure of liquidity which excludes the amount of inventory from current asset value.

For the goodness of fit, Hosmer-Lemeshow (HL) test is computed for the logistic regression model. Small p-value (usually under 5%) of HL test indicates that the model is a poor fit (Hosmer, Lemeshow, & Sturdivant, 2013). As the *p-value* of HL test is greater

than 50% (i.e. 0.517), therefore stage-two model is good fit and well-specified. Similarly, the value of McFadden R^2 between 0.2 to 0.4 represents that the model is good fit (McFadden, 1973). As the obtained value of McFadden R^2 is between this range therefore stage-two model is good fit. Finally, the results obtained from Expectation-Predication test are also provided in same table. Results show that overall the model correct predicts 1,131 (72.1%) firm-year observations of the binary responses. Related to this case, 1,006 (92.7%) of the derivative nonusers are correctly classified in contrast to 125 (25.9%) of users who are correctly classified. This latter statistic does point to a legitimate concern over the logistic regression model—it is poor at correctly classifying users of FCDs in sample.

4.3 Robustness Analysis

Robustness analyses are performed in the study by several ways. First, the sensitivity of SIZE in stage-two model is tested by omitting it from the model and impact on results of other explanatory variables is examined. Second, the stage-two model is re-estimated by using dichotomous measurement of FX exposure coefficient (i.e. assigning 0 & 1 to insignificant and significant coefficients respectively) to examine the effect on results. Third, the sensitivity of market portfolio index in exposure model is tested by introducing Malaysian market portfolio index, i.e. FBMEMAS, in equation 3.1. The coefficient of FX exposure (estimated after including market index in the model) is then re-estimated in stage-two model to examine its impact on FCDs use. Fourth, sensitivity of exposure to different time horizon is also tested by estimating results in two different time horizons; i.e. weekly and monthly, and the findings are compared with daily results. In addition to that, the impact of weekly and monthly exposure coefficient on FCDs use is then examined

through stage-two model. Fifth, the robustness across different bilateral exchange rates is also tested by using different currency pairs and the significance of each currency exposure coefficient in determining the use of FCDs is also examined. Finally, robustness of results is also tested by using different alternative variable measurements.

4.3.1 Sensitivity of 'SIZE' in Stage-two Model

Correlation analysis did not find severe correlation between explanatory variables of stage-two model as the highest correlation is found 0.360, and the VIF value of all variables is also less than two. However, unlike other variables such as FSTS, the correlation coefficients between SIZE and other variables (with the exception of φ^D) are highly significant at 1% significance level which signifies that SIZE may have considerable influence on the significance of other explanatory variables. Therefore, the sensitivity of SIZE in stage-two model is tested by dropping it from the model.

The results of stage-two model after dropping SIZE are presented in Table 4.8. Results suggest that SIZE co-opts the explanatory power of the RMC, MTBV and LIQ as it has significant influence on the results of these three explanatory variables. For example, RMC which was previously insignificant, now become highly statistically significant at 1% level[21]. Similarly, MTBV now become highly significant at 1% level which was previously insignificant. Likewise, INCOV which was previously significant at 10% level now become highly significant at 1% level. In a same way, LIQ now become statistically

[21] See Table 4.7 for results comparison

significant at 10% level which was previously insignificant. All these facts validate the effects of SIZE on other variables in stage-two model as it significantly influences other explanatory variables.

Table 4.8
Results showing sensitivity of SIZE in stage-two model

	Results after omitting SIZE from stage-two model		Results after omitting RMC, MTBV and LIQ from stage-two model	
Predictor	**Coefficient Estimate**	***P-value***	**Coefficient Estimate**	***P-value***
Constant	-1.597	0.0000***	-8.374	0.000***
φ^D	-0.506	0.002***	-0.521	0.002***
RMC	0.369	0.002***	---	---
CAPEX (%)	0.010	0.485	-0.002	0.870
MTBV	0.273	0.010***	---	---
INCOV	0.013	0.002***	0.008	0.065*
LVRG	5.744	0.000***	3.216	0.006***
SIZE	---	---	0.576	0.000***
FSTS (%)	0.014	0.000***	0.010	0.000***
LIQ	-0.081	0.090*	---	---

*** significant at 1% ** significant at 5% * significant at 10%

This table presents the result summary (with estimated coefficients and p-values) of the explanatory variables used in stage-two model after omitting SIZE from the model (at first step), and after omitting RMC, MTBV and LIQ from the model (at second step). φ^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is measured as natural log of total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

Although results provide evidence that SIZE co-opts the explanatory power of the RMC, MTBV and LIQ, stage-two model is again estimated by omitting RMC, MTBV and LIQ to examine the effect of their omission on SIZE. Results are presented in Table 4.8 in last two columns. It is evident from the table that the significance of SIZE does not change when RMC, MTBV and LIQ are omitted as it is still significant at 1% level. This shows that there is no impact on SIZE by the omission of these three explanatory variables.

4.3.2 Results after Using Dichotomous Measurement of β_1 in Stage-two Model

Earlier, β_1 (FX rate exposure) was estimated for all sampled firms, however, for some firms, β_1 is not significant. In order to test the effects of significant β_1 on FCDs use, the stage-two model is re-estimated by taking dichotomous (binary) measurement of β_1. To achieve this, β_1 is assigned a value of '0' if it is insignificant at 10% level and '1' otherwise and it is denoted by $\beta^{(0,1)}$. After that, stage-two model is run by using $\beta^{(0,1)}$ along with other explanatory variables.

Results of stage-two model after using $\beta^{(0,1)}$as an explanatory variable are exhibited in Table 4.9. Results indicate that $\beta^{(0,1)}$ is still significant, albeit at 10 % level. Thus, the way β_1 is measured does not influence the results. Furthermore, there is no significant impact on the results of other explanatory variables as the significance of other variables remains unchanged.

Table 4.9

Results of stage-two model after using $\beta^{(0,1)}$ as an explanatory variable

Predictor	**Coefficient Estimate**	***P-value***	**Odds Ratios**	**Std. Error**
Constant	-8.831	0.000**	0.000	0.806
$\beta^{(0,1)}$	-0.240	0.051*	0.787	0.123
RMC	0.139	0.255	1.149	0.122
CAPEX (%)	-0.001	0.943	0.999	0.015
MTBV	0.145	0.198	1.156	0.113
INCOV	0.009	0.031**	1.009	0.004
LVRG	3.049	0.010***	21.104	1.191
SIZE	0.570	0.000***	1.769	0.064
FSTS (%)	0.010	0.000***	1.010	0.002
LIQ	-0.002	0.975	0.998	0.047

*** significant at 1% ** significant at 5% * significant at 10%

This table presents the result summary (with estimated coefficients, p-values, Odds ratios and standard error) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \beta^{(0,1)} + \alpha_2 RMC_{it} + \alpha_3 CAPEX_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; $\beta^{(0,1)}$ is the dummy variable which takes the value of '1' if β_1 is significant and '0' otherwise; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

4.3.3 Sensitivity of Market Portfolio Index

Although several studies in empirical literature provide evidence on firm's total exposure[22] to exchange rate changes, however, some researchers also add control variables, such as market portfolios, in empirical exposure model and estimate *residual* FX exposure[23] for different economies (e.g., see Allayannis, 1997; Bodnar & Gentry, 1993; Chamberlain et al., 1997; Choi & Prasad, 1995; Loudon, 1993; Williamson, 2001). These market portfolio indices control for macro-economic effects, such as changes in expected interest rate, market risk premium, unexpected inflation, variations in risk-free rate, industrial production growth, and investor sentiment, that affect valuation of all firms (Bodnar & Wong, 2003).

The incorporation of a market portfolio index as an explanatory variable in exposure model plays a substantial role in determining economically meaningful point estimates as well as the true extent of FX exposure (Bodnar & Wong, 2003). Dominguez and Tesar (2006), Ito et al. (2016), Priestley and Ødegaard (2002) and Bodnar and Wong (2003) highlight some potential issues related to the inclusion of market portfolio index in the exposure model. Firstly, sometimes market portfolio index as a whole become strongly correlated with exchange rate changes and, in result, it dramatically reduces the residual exposure even though total exposure is high. This adversely affects the true estimation of residual

[22] Refers to the exposure estimated without incorporating macroeconomic effects (i.e. market portfolio index) in exposure model (Bodnar & Wong, 2003; Dominguez & Tesar, 2006; Du et al., 2014; Koutmos & Martin, 2007; Pritamani et al., 2004).
[23] Also called *incremental exposure*, refers to the exposure obtained after accounting for macroeconomic effects in exposure model usually proxied by return on market portfolio index (Bodnar & Wong, 2003; Koutmos & Martin, 2007; Parsley & Popper, 2006).

exposure and confounds the estimated exposure interpretation. Secondly, exposure estimates tend to be very noisy by the inclusion of market portfolio index and their statistical significance may deteriorate. Finally, sometimes the inclusion of market portfolio index in exposure model does not put any impact on estimation of FX exposure. Jorion (1990), who first introduces market portfolio index in exposure model, reports that his original results remain unchanged after the market index was added in the model. Similarly, the findings of Levi (1994) are not changed after including market portfolio index into the exposure model.

Although, total FX exposure of Malaysian firms is estimated and discussed earlier in this chapter, however, this study also tests the impact of market portfolio index on empirical results by incorporating it in exposure model by following Jorion (1990) among others. Therefore, the augmented exposure model would be:

$$R_{it} = \gamma_1 + \gamma_2 RM_t + \gamma_3 TWI_t^{JPM} + \theta_{it} \qquad \text{Equation 4.1}$$

Where, R_{it} is the daily return on *i*th firm's common stock in period *t;* TWI_t^{JPM} is the daily return on JP Morgan TWI measured in MYR per one unit of a basket of foreign currencies; γ_1 and θ are intercept and error term respectively; while γ_2 and γ_3 are the coefficients of market portfolio index and TWI respectively. Finally, RM_t is the daily return on Malaysian market portfolio index in period *t.* FBMEMAS is used as a proxy of market portfolio index. Previous Malaysian studies, such as Bacha et al. (2012), Ramasamy (2000) and Pillay and Rangel (2002), used FBMKLCI as a proxy of market portfolio index while measuring FX exposure. This study selects FBMEMAS for result robustness; reasons are twofold. First,

FBMKLCI & FBMEMAS indexes are highly correlated with each other; hence, no significant differences in results are expected by using either index[24]. Second, the limitation of using FBMKLCI is that it consists of only 30 stocks, whereas, in contrast, FBMEMAS is a broader index than FBMKLCI in which total number of constituents are 262. For these reasons, this study, therefore, uses FBMEMAS and expects to obtain relatively more robust and generalized results.

Results of Augmented Exposure ModelTable 4.10 demonstrates the comparison between significant coefficients of market portfolio index, i.e., RM, and TWI at different significance levels. If we take the 5% significance level as basis of comparison then it is obvious from the table that the number of significant coefficients of RM remains high throughout the sample period than that of TWI. A total of 67% (1045) firm-year coefficients of RM are significant over the period of 2008 to 2014 as compared to 9% (139) significant firm-year coefficients of TWI. Less than 10% of all firms are exposed to less FX risk in all years with the exception of 2010 in which 17% (39) firms are exposed to exchange rate risk. In 2008, the lowest number of firms, i.e. 13 (6%), is affected by the changes in exchange rate. These findings indicate that firm's exposure to TWI dramatically reduces after the inclusion of RM. This also implies that firms are exhibiting more exposure to market portfolio index in all years as compared to exchange rate changes after the inclusion of RM in stage-one model.

[24] Pearson correlation between FBMEMAS and FBMKLCI was found 0.999 highly significant at 0.01 level.

Table 4.10
Results after incorporating RM in stage-one model

	Significance at 1% level		**Significance at 5% level**		**Significance at 10% level**	
Years	*RM*	*TWI*	*RM*	*TWI*	*RM*	*TWI*
2008	140 (63%)	3 (1%)	159 (71%)	13 (6%)	170 (76%)	29 (13%)
2009	111 (50%)	6 (3%)	134 (60%)	16 (7%)	145 (65%)	31 (14%)
2010	103 (46%)	19 (8%)	134 (60%)	39 (17%)	150 (67%)	45 (20%)
2011	145 (65%)	3 (1%)	158 (71%)	20 (9%)	165 (74%)	28 (13%)
2012	80 (36%)	6 (3%)	109 (49%)	19 (8%)	130 (58%)	39 (17%)
2013	140 (63%)	5 (2%)	164 (73%)	14 (6%)	172 (77%)	31 (14%)
2014	171 (76%)	4 (2%)	187 (83%)	18 (8%)	198 (88%)	33 (15%)
Total*	**890 (57%)**	**46 (3%)**	**1045 (67%)**	**139 (9%)**	**1130 (72%)**	**236 (15%)**

* Total percentages are obtained out of 1568 firm-year observations (i.e. 224 x 7)

This table presents the summary of stage-one mode (or augmented exposure model) estimated after adding market portfolio index. This model estimates the FX rate exposure of 224 nonfinancial Malaysian firms over the period of 2008 to 2014 after controlling macroeconomic effects. The augmented exposure model is: $R_{it} = \gamma_1 + \gamma_2 RM_t + \gamma_3 TWI_t^{JPM} + \theta_{it}$; where R_{it} refers to the return rate on ith firm's security in time t*;* RM_t is the daily return on Malaysian market portfolio index (i.e. FBMEMAS) in period *t;* TWI_t^{JPM} is the JP Morgan TWI used as a proxy of exchange rate changes and measured in MYR per unit of a basket of foreign currencies; γ_1 is the intercept of the regression equation; γ_2 is the coefficient of RM_t*;* γ_3 is the coefficient of TWI refers to FX exposure; and lastly, θ_{it} is the regression residual for the *i*th firm in period *t.*

Table 4.11 makes comparison between significant TWIs with and without incorporating RM in exposure model over the sample period. It is evident from the table that firms are more exposed to the changes in TWI in the absence of market index in exposure model. After adding market index, firms' exposure to exchange rate drastically reduced. A total of 37% firm-year observations are significant without adding market index; whereas, this figure is reduced to 9% when exposure is estimated along with market index as shown in

Figure 4.3. In both cases (with and without market index), 2010 and 2011 are found to be the most significant years in which maximum number of firms are exposed to exchange rate changes; while in 2008 the least number of firms is exposed to exchange rate volatilities.

Table 4.11
Comparison of significant TWIs with and without using RM in stage-one model at 5% level

	Significance at 5% level	
Years	*TWI (without RM)* *	*TWI (with RM)* **
2008	61 (27%)	13 (6%)
2009	76 (34%)	16 (7%)
2010	93 (42%)	39 (17%)
2011	112 (50%)	20 (9%)
2012	71 (32%)	19 (8%)
2013	79 (35%)	14 (6%)
2014	94 (42%)	18 (8%)
Total^	**586 (37%)**	**139 (9%)**

* This column is extracted from Table 4.2 ** This column is extracted from Table 4.10.
^ Total percentages are obtained out of 1568 firm-year observations (i.e. 224 x 7)
This table compares the results of significant coefficients of TWI which were earlier estimated with and without using RM_t in Table 4.2 and Table 4.10 respectively.

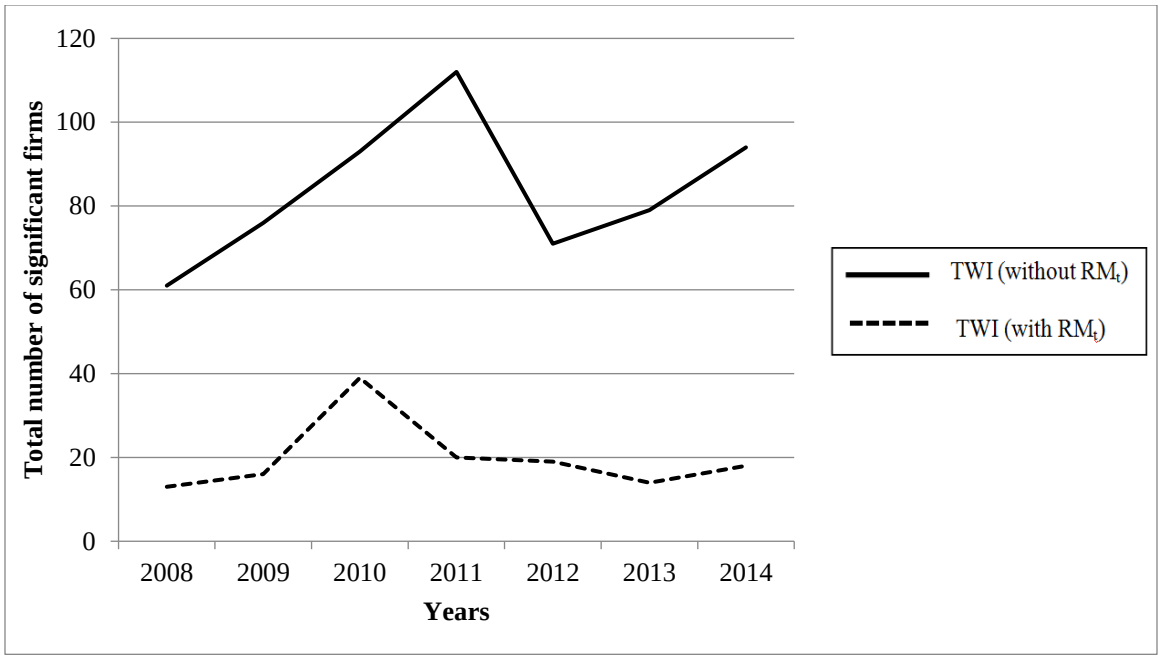

Figure 4.2
Comparison of significant TWIs with and without using RM in stage-one model at 5% level

4.3.3.1 Sensitivity of γ_3 in Stage-two Model

Although FX exposure (γ_3) of Malaysian firms, estimated through augmented exposure model[25], become considerably reduced after including market portfolio index (RM) in the model, the sensitivity of γ_3 needs to be tested in stage-two model as an explanatory variable to check how much it explains the use of FCDs and to what extent it affects other variables. For this purpose, γ_3 is transformed by taking its absolute values in order to become indifferent between positive and negative exposure. Subsequently, square root is taken for

[25] i.e. *Equation 4.1*

each absolute value ($\sqrt{|\gamma_{3it}|}$) to avoid the influence of truncation bias. φ_{it}^{AUG} is used to refer to the square root of absolute values of γ_3 for *i*th firm in period *t*.

Table 4.12
Results of stage-two model after using transformed γ_3 as an explanatory variable

Predictor	**Coefficient Estimate**	***P-value***	**Odds Ratios**	**Std. Error**
Constant	-8.532	0.000***	0.000	0.860
φ^{AUG}	-0.014	0.939	0.986	0.189
RMC	0.133	0.278	1.142	0.122
CAPEX (%)	-0.001	0.962	0.999	0.015
MTBV	0.120	0.283	1.128	0.112
INCOV	0.009	0.038**	1.009	0.004
LVRG	3.049	0.011**	21.097	1.193
SIZE	0.542	0.000***	1.719	0.064
FSTS (%)	0.010	0.000***	1.010	0.002
LIQ	-0.001	0.978	0.999	0.048

*** significant at 1% ** significant at 5% * significant at 10%

This table presents the result summary (with estimated coefficients, p-values, Odds ratios and standard error) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^{AUG} + \alpha_2 RMC_{it} + \alpha_3 CAPEX_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^{AUG} is the square root of the absolute value of each γ_3 estimated through equation 4.1 (augmented exposure model); RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

Table 4.12 shows the results of stage-two model estimating the effect of φ^{AUG} (transformed FX exposure coefficient) on FCDs use along with other explanatory variables. It is evident

from the table that φ^{AUG} is insignificant which implies that φ^{AUG} does not explain the use of FCDs by Malaysian firms. In other words, it can be concluded that firms have too low FX exposure to explain the use of derivative financial instruments. However, the inclusion of φ^{AUG} does not significantly affect the results of other explanatory variables of the model.

As earlier discussed, several studies (Bodnar & Wong, 2003; Dominguez & Tesar, 2006; Ito et al., 2016; Priestley & Ødegaard, 2002) argue that sometimes market portfolio index as a whole is strongly correlated with the exchange rate changes which adversely affects the true estimation of FX exposure and the results of this study are exactly confront the same issue. It has been observed previously that inclusion of market portfolio index strikingly reduced the residual exposure by 76%. Therefore, market portfolio index is dropped from the exposure model and subsequent robustness analyses will continue with single explanatory variable, i.e. TWI, in stage-one model.

4.3.4 Sensitivity of Exposure to Horizon

In the main analysis (in section 4.1), results regarding FX exposure of Malaysian firms are estimated and discussed by using daily returns on firm's stock and TWI based on the argument of Di Iorio and Faff (2000) and Chamberlain et al. (1997) among others, that daily data provides better results of sensitivity than weekly and monthly data. Subsequently (in section 4.3.3), the estimated coefficient of TWI (refers to exchange rate exposure) is transformed by taking square root of its absolute values and used in stage-two model as an explanatory variable to determine the extent to which Malaysian firms are induced towards the use of FCDs due to FX exposure along with other explanatory variables.

In literature, there are some contradictory arguments against short return horizon and various studies report potential problems of using short return horizon (i.e. daily and weekly). Allayannis and Ofek (2001) assert that the problem of non-synchronous trading arises with the daily data which is the non-alignment of stock returns and exchange rate series. Similarly, Bodnar and Wong (2003) identify that, over longer horizons, exposure to foreign currency risk may be more accurately estimated due to the noise in high frequency observations of FX rates and complexity of various factors affecting FX exposures. De Jong et al. (2006), for example, use bi-weekly data because of the noise in daily and weekly series.

Many studies also argue that sometimes it becomes difficult to identify short-term FX exposure because stock returns for short horizon are intent to measure operating exposure which can be easily eliminated by firms through several other hedging techniques (see Bartov & Bodnar, 1994; Bodnar & Gentry, 1993; Chow et al., 1997a). Similarly, various studies, such as Dominguez and Tesar (2006), El-Masry and Abdel-Salam (2007), Hutson and Stevenson (2010), Jorion (1990), Muller and Verschoor (2007), Tai (2008) and Yip and Nguyen (2012), are in a favor of using weekly and monthly data as they are regarded more suitable for the purpose of measuring exchange rate exposure. These arguments suggest that the results of this study based on daily returns may understate the true extent of exposure. Based on a conjecture that using longer horizon returns can yield a better measure of FX exposure, this study, therefore, tests the sensitivity of longer return horizon to exchange rate changes by focusing on firms' weekly and monthly data.

4.3.4.1 Sensitivity of FX Exposure to Weekly Return Horizon

For estimating weekly FX exposure of Malaysian firms from 2008 to 2014, weekly returns are calculated from Wednesday to Wednesday in order to prevent an end-of-the-week effect as in Dominguez and Tesar (2006), Dominguez and Tesar (2001) and De Jong et al. (2006). In case the Wednesday is missing, the first following trading day is taken. Weekly FX exposure coefficients are estimated over the sample period through equation 3.1 and the results are presented in Table 4.13. The significance of weekly FX exposure coefficients is given at 1%, 5% and 10% level. For comparison, results of daily FX exposure coefficients are also provided in same table.

If we take the 5% significance level as a basis of comparison, it can be concluded that obtained findings run counter to the conjecture that the greater the return horizon, the higher the FX exposure since more firms are exposed to exchange rate risk in shorter horizon (daily) as compared to longer (weekly) horizon. It is obvious from the table that overall 316 (20%) firm-year observations are significantly exposed to weekly exchange rate changes as compared to 586 (37%) firm-year observations that are significantly exposed to daily FX exposure during the sample period. 2008 and 2010 are years with the most extreme cases regarding low and high number of firms that are exposed to FX risk respectively. In 2008, only 8% (19) firms are exposed to exchange rate fluctuations, while, in contrast, 30% (67) firms are exposed to exchange rate risk in 2010.

Table 4.13
Comparison of weekly and daily FX rate exposure

	Significance of exposure coefficient (β_1) with Weekly return			Significance of exposure coefficient (β_1) with Daily return*		
Years	**1%**	**5%**	**10%**	**1%**	**5%**	**10%**
2008	2 (0.9%)	19 (8%)	34 (15%)	30 (13%)	61 (27%)	79 (35%)
2009	27 (12%)	58 (26%)	84 (38%)	39 (17%)	76 (34%)	104 (46%)
2010	31 (14%)	67 (30%)	89 (40%)	60 (27%)	93 (42%)	111 (50%)
2011	27 (12%)	63 (28%)	94 (42%)	83 (37%)	112 (50%)	136 (61%)
2012	6 (3%)	26 (12%)	41 (18%)	29 (13%)	71 (32%)	98 (44%)
2013	21 (9%)	54 (24%)	76 (34%)	43 (19%)	79 (35%)	100 (45%)
2014	13 (6%)	29 (13%)	52 (23%)	50 (22%)	94 (42%)	117 (52%)
Total**	**127 (8%)**	**316 (20%)**	**470 (30%)**	**334 (21%)**	**586 (37%)**	**745 (48%)**

* Values extracted from Table 4.2

** Total percentages are obtained out of 1568 firm-year observations (i.e. 224 x 7)

Weekly FX rate exposure of 224 Malaysian nonfinancial firms is estimated for the period of 2008 to 2014 through Equation 3.1, i.e., $R_{it} = \beta_0 + \beta_1 TWI_t^{JPM} + \acute{\varepsilon}it$, where, R_{it} refers to the weekly return rate on *i*th firm's security in time *t*. TWI_t^{JPM} is the weekly return on JP Morgan TWI measured in MYR per unit of a basket of foreign currencies. β_0 is the intercept of the regression equation, while β_1 is the coefficient of TWI sensitivity and measures weekly FX rate exposure. Lastly, $\acute{\varepsilon}_{it}$ is the regression residual for the *i*th firm in period *t*.

Although lower number of firms are exposed to weekly as compared to daily FX exposure, however, the sensitivity of weekly FX exposure coefficient (β_1) is to be tested in stage-two model as an explanatory variable to check how much weekly FX exposure explains the use of FCDs and to what extent it affects other variables. For this purpose, β_1 is transformed by taking the square root of absolute values of all weekly exposure coefficients ($\sqrt{|\beta_{1it}|}$) and it is denoted by φ_{it}^{W}.

Table 4.14
Results of stage-two model after using φ^W as explanatory variable

Predictor	**Coefficient Estimate**	***P-value***	**Odds Ratios**	**Std. Error**
Constant	-7.886	0.000***	0.000	0.813
φ^W	-0.443	0.000***	0.642	0.122
RMC	0.138	0.259	1.148	0.123
CAPEX (%)	-0.001	0.936	0.999	0.015
MTBV	0.114	0.309	1.121	0.113
INCOV	0.008	0.080*	1.008	0.004
LVRG	2.919	0.015**	18.527	1.197
SIZE	0.535	0.000***	1.707	0.063
FSTS (%)	0.010	0.000***	1.010	0.002
LIQ	-0.018	0.702	0.982	0.048

*** significant at 1% ** significant at 5% * significant at 10%

This table presents the result summary (with estimated coefficients, p-values, Odds ratios and standard error) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^W + \alpha_2 RMC_{it} + \alpha_3 CAPEX_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^W is the square root of the absolute value of each β_1 estimated through equation 3.1; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

Table 4.14 demonstrates the results of stage-two model in estimating the effect of φ^W on FCDs use along with other explanatory variables. It is evident from the table that the significance of φ^W remains unchanged as it is still highly significant (α_1 = -0.443, *p*-value < 0.01) which signifies the fact that behavior of Malaysian firms for using FCDs does not change in daily and weekly return horizon. Moreover, the sign of the φ^W is still negative

indicating the use of FCDs decreases as weekly FX exposure increases and vice versa. This is possibly due to adopting other hedging techniques like natural hedging, operation hedging and non-derivative hedging by Malaysian firms. In addition to that, φ^W does not affect the results of other explanatory variables as their estimated coefficients and significance almost remains same with slight differences.

4.3.4.2 Sensitivity of FX Exposure to Monthly Return Horizon

In order to estimate monthly FX rate exposure of Malaysian firms during the period of 2008 to 2014, this study uses return on the 15th day of each month in order to circumvent end-of-the-month effects as in Williamson (2001) and De Jong et al. (2006). In case the 15th day is missing, the first following trading day is taken. Monthly FX exposure coefficients are estimated through Equation 3.1 and results are presented in

Table 4.15. The significance of monthly FX exposure coefficients is given at 1%, 5% and 10% level. For comparison, results of daily and weekly FX exposure coefficients are also provided in same table. By taking 5% significance level as a basis of comparison, it can be concluded that FX exposure decreases as the time horizon increases which is inconsistent with the exposure conjecture that the greater the return horizon, the higher the FX exposure. Specifically, considerable differences are observed between exposure at daily and monthly returns over the sample period as daily returns yield highest exposure to sampled firms.

Table 4.15
Comparison of monthly, weekly and daily FX rate exposure

	Significance of exposure coefficient (β_1) with Monthly return			Significance of exposure coefficient (β_1) with Weekly return*			Significance of exposure coefficient (β_1) with Daily return**		
Years	**1%**	**5%**	**10%**	**1%**	**5%**	**10%**	**1%**	**5%**	**10%**
2008	3 (1%)	11 (5%)	27 (12%)	2 (0.9%)	19 (8%)	34 (15%)	30 (13%)	61 (27%)	79 (35%)
2009	1 (0.4%)	12 (5%)	20 (9%)	27 (12%)	58 (26%)	84 (38%)	39 (17%)	76 (34%)	104 (46%)
2010	2 (0.9%)	16 (7%)	27 (12%)	31 (14%)	67 (30%)	89 (40%)	60 (27%)	93 (42%)	111 (50%)
2011	2 (0.9%)	18 (8%)	30 (13%)	27 (12%)	63 (28%)	94 (42%)	83 (37%)	112 (50%)	136 (61%)
2012	8 (4%)	25 (11%)	40 (18%)	6 (3%)	26 (12%)	41 (18%)	29 (13%)	71 (32%)	98 (44%)
2013	3 (1%)	8 (4%)	27 (12%)	21 (9%)	54 (24%)	76 (34%)	43 (19%)	79 (35%)	100 (45%)
2014	21 (9%)	73 (32%)	102 (46%)	13 (6%)	29 (13%)	52 (23%)	50 (22%)	94 (42%)	117 (52%)
Total^	**40 (3%)**	**163 (10%)**	**273 (17%)**	**127 (8%)**	**316 (20%)**	**470 (30%)**	**334 (21%)**	**586 (37%)**	**745 (48%)**

* Values extracted from Table 4.13 ** Values extracted from Table 4.2

^ Total percentages are obtained out of 1568 firm-year observations (i.e. 224 x 7)

Monthly FX rate exposure of 224 Malaysian nonfinancial firms is estimated for the period of 2008 to 2014 through Equation 3.1, i.e., $R_{it} = \beta_0 + \beta_1 TWI_t^{JPM} + \acute{\varepsilon}it$, where, R_{it} refers to the monthly return rate on *i*th firm's security in time *t*. TWI_t^{JPM} is the monthly return on JP Morgan TWI measured in MYR per unit of a basket of foreign currencies. β_0 is the intercept of the regression equation, while β_1 is the coefficient of TWI sensitivity and measures monthly FX rate exposure. Lastly, $\acute{\varepsilon}_{it}$ is the regression residual for the *i*th firm in period *t*.

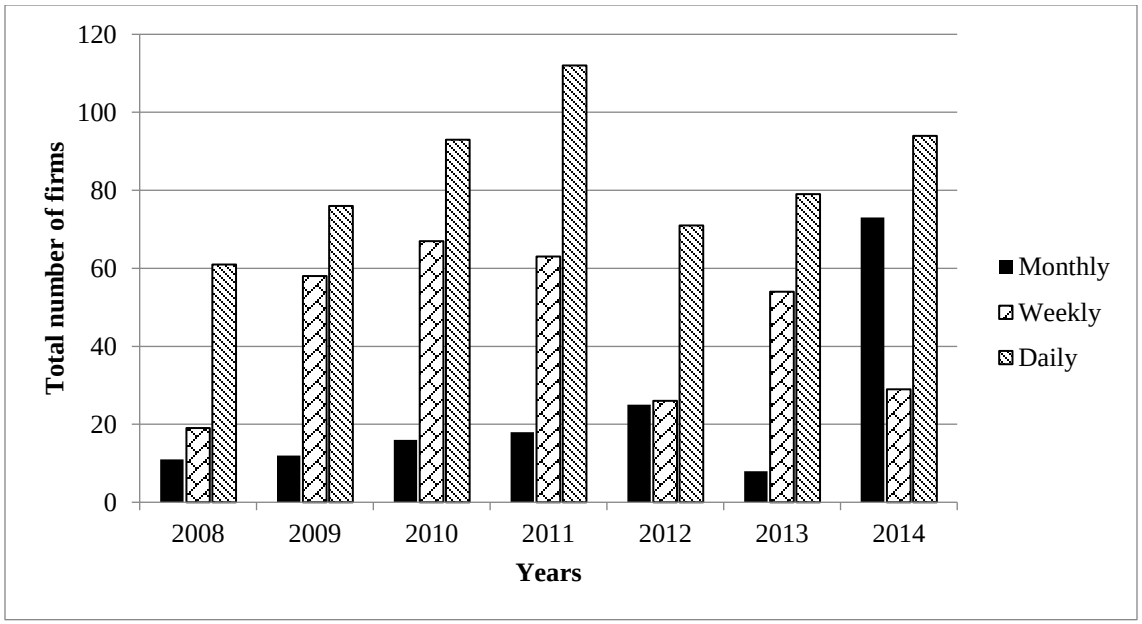

Figure 4.3
Significance of sampled firms to monthly, weekly and daily return horizons at 5% level

It is obvious from the table that less firms are exposed to exchange rate risk in monthly as compared to weekly and daily return horizon as depicted in Figure 4.3. Overall 163 (10%) firm-year observations are significantly exposed to monthly exchange rate changes. This figure is almost half of the number of firms that are exposed to weekly exposure and less than one-third of the firms that are exposed to daily exposure during the sample period. FX exposure in 2013 and 2014 stands out as the most extreme cases for monthly return as the exposure is extremely low and high in these years respectively. In 2013, the monthly exposure is at the lowest level when only 8 (4%) firms exhibit FX exposure. Quite the opposite, this figure becomes overwhelmingly higher in 2014 when 73 (32%) firms are exposed to exchange rate changes. These results are consistent with the Di Iorio and Faff (2000) and Chamberlain et al. (1997) who find higher firm exposures in shorter return horizons for their sampled firms.

Although fewer firms are exposed to monthly as compared to daily and weekly FX exposure, however, the sensitivity of monthly FX exposure coefficient (β_1) is tested in stage-two model as an explanatory variable to check how much monthly FX exposure explains the use of FCDs and to what extent it affects other explanatory variables. For this purpose, β_1 is transformed by taking the square root of absolute values of all monthly exposure coefficients ($\sqrt{|\beta_{1it}|}$) and it is denoted by φ_{it}^{M}.

Table 4.16
Results of stage-two model after using φ^M as explanatory variable

Predictor	**Coefficient Estimate**	***P-value***	**Odds Ratios**	**Std. Error**
Constant	-8.022	0.000***	0.000	0.811
φ^M	-0.227	0.002***	0.797	0.074
RMC	0.146	0.233	1.157	0.122
CAPEX (%)	-0.002	0.905	0.998	0.015
MTBV	0.128	0.254	1.137	0.112
INCOV	0.008	0.071*	1.008	0.004
LVRG	3.186	0.008***	24.200	1.196
SIZE	0.530	0.000***	1.699	0.063
FSTS (%)	0.010	0.000***	1.010	0.002
LIQ	-0.008	0.864	0.992	0.048

*** significant at 1% ** significant at 5% * significant at 10%

This table presents the result summary (with estimated coefficients, p-values, odds ratios and standard error) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^{M} + \alpha_2 RMC_{it} + \alpha_3 CAPEX_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^{M} is the square root of the absolute value of each β_1 estimated through equation 3.1; RMC is a dummy variable which equals to '1' if a firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

Table 4.16 demonstrates the results of stage-two model estimating the effect of φ^M on FCDs use along with other explanatory variables. It is evident from the table that the φ^M still remains highly significant (α_1 = -0.227, *p*-value < 0.01) which signifies the fact that behavior of Malaysian firms for using FCDs does not influence in different time horizons i.e., daily, weekly and monthly. Moreover, the sign of the φ^M is still negative indicating the use of FCDs decreases as monthly FX exposure increases and vice versa. In addition to that, φ^M did not affect the results of other explanatory variables as their estimated coefficients and significance almost remains same with minor differences.

In summary, the results of section 4.3.4 provide evidence that the exposure to exchange rate changes is time variant but variation in exposure is inversely proportional to time horizon. The results run counter to the conjecture that the greater the time horizon, the greater the FX rate exposure. The findings prove that as the time horizon decreases, the exposure to exchange rate changes increase during the sample period. However, the use of FCDs by Malaysian firms does not change with the change in time horizon of FX exposure. Therefore, subsequent analysis continues with daily time horizon as it yields highest exposure to Malaysian firms among all time horizons.

4.3.5 Robustness Across Different Bilateral Exchange Rates

Previously, FX exposure of Malaysian firms is estimated by using TWI measured in MYR per one unit of a basket of foreign currencies. Although several studies (such as Allayannis & Ofek, 2001; Bodnar & Gentry, 1993; He & Ng, 1998; Nguyen et al., 2007; Zhou & Wang, 2013) support the use of TWI for estimating currency exposure, however, on the

other side, there are some competing arguments against the use of TWI in exposure model which are discussed below.

Firstly, some studies argue that the use of TWI as a proxy of exchange rate may underestimate the true extent of exposure. Williamson (2001), for example, points out the same limitation of using TWI in exposure model that the results lack power if a firm is significantly exposed against small number of currencies. He argues that firm's exposure to exchange rate might be underestimated if a firm exposed to only some of the currencies with the basket. This implies that exposure to the TWI and different bilateral exchange rate may significantly different with each other. This is confirmed by Dominguez and Tesar (2006) when their results show higher exposure with bilateral exchange rates as compared to TWI; since TWI understate their firms' exposure. They argue that, while estimating FX exposure, the use of TWI may not be a good indicator of overall firm's exposure for various economies.

Secondly, Nguyen and Faff (2003a) criticize the use of TWI while measuring firm's exposure profile because the firm's international linkages are supposed to be similar to that of the domestic trade and variations in TWI are assumed to influence individual firms in a uniform manner. Consequently, the use of TWI may lead towards aggregation biases which undermine the effort to estimate firm specific exchange rate coefficients for individual currencies.

Thirdly, De Jong et al. (2006) argue that firm's sensitivity to FX rate changes may not be correctly captured by using TWI in exposure model. The weights of TWI are calculated

from national trade figures with foreign countries. Therefore, using trade-weighted indices implicitly assumed that these national trade figures and individual firm's characteristics are uniformly related with each other. This may not be true for all economies and therefore using a TWI may bias the empirical results. Finally, Miller and Reuer (1998b) argue that a TWI disregards the problem of negative and low correlations among FX rates.

To address these issues, this study re-estimates the FX exposure of Malaysian firms at daily horizon over the sample period by using five different bilateral exchange rates that are most relevant to Malaysian firms, namely the US Dollar (USD), the Singapore Dollar (SGD), the Great Britain Pound (GBP), the Australian Dollar (AUD) and the Japanese Yen (JPY). These currencies are selected after analyzing the annual reports of Malaysian firms over the sample period. Most of the firms mentioned in their annual reports that respective currency countries are the most important and frequent trading partners of Malaysia and they are having high currency exposure against these currencies. Furthermore, Bacha et al. (2012) also use same currencies while estimating FX rate risk for Malaysian firms.

Table 4.17
Robustness across different bilateral exchange rates at daily horizon

	2008	2009	2010	2011	2012	2013	2014	Total
USD								
1%	11	5	39	5	16	7	13	96
5%	32	22	66	25	42	29	35	**251**
10%	48	38	88	43	58	40	52	367
SGD								
1%	10	8	3	33	5	5	3	67
5%	28	23	17	61	24	18	20	**191**
10%	49	34	26	84	38	33	34	298
GBP								
1%	7	4	4	3	6	2	1	27
5%	25	8	10	14	21	15	11	**104**
10%	42	22	23	24	35	22	15	183
AUD								
1%	10	18	6	25	0	2	4	65
5%	25	39	17	64	13	12	23	**193**
10%	40	51	26	95	20	21	38	291
JPY								
1%	33	5	7	24	3	3	14	89
5%	64	21	20	49	11	11	40	**216**
10%	82	35	34	61	19	26	62	319
Total								
1%	71	48	59	90	30	19	35	
5%	**174**	**113**	**130**	**213**	**111**	**85**	**129**	
10%	261	180	197	307	170	142	201	

This table presents the summary of exposure model estimating FX exposure of 224 Malaysian nonfinancial firms across five different currencies at 1%, 5% and 10% significance level during the sample period of 2008-2014. The model is: $R_{it} = \beta_0 + \beta_{it}^{USD}$ USD + β_{it}^{SGD} SGD + β_{it}^{GBP} GBP + β_{it}^{AUD} AUD + β_{it}^{JPY} JPY + $\acute{\varepsilon}_{it}$
Where, R_{it} refers to the daily return rate on *i*th firm's security in time *t;* β_0 is the intercept of the regression equation; USD refers to the bilateral exchange rate measured in MYR per unit of US Dollar; SGD refers to the bilateral exchange rate measured in MYR per unit of Singapore Dollar; GBP refers to the bilateral exchange rate measured in MYR per unit of Great Britain Pound; AUD refers to the bilateral exchange rate measured in MYR per unit of Australian Dollar; JPY refers to the bilateral exchange rate measured in MYR per unit of Japanese Yen; β_{it}^{USD} is the coefficient of USD measures FX exposure to US Dollar; β_{it}^{SGD} measures FX exposure to Singapore Dollar; β_{it}^{GBP} measures FX exposure to Great Britain Pound; β_{it}^{AUD} measures FX exposure to Australian Dollar; β_{it}^{JPY} measures FX exposure to Japanese Yen and $\acute{\varepsilon}_{it}$ is the regression residual for the *i*th firm in period *t.*

If we take 5% significance level as a basis of comparison, Table 4.17 reveals some facts. In 2010, for example, a maximum number of firms, i.e., 66, are exposed to exchange rate risk against the USD, while, in contrast, the least number of firms, i.e., 8, exhibit FX exposure in 2009 against the GBP. Similarly, USD stands out at the top among all currencies which yield highest exposure to Malaysian firms over the sample period. On the contrary, GBP is a currency which give least exposure to sampled firms during sample period. Likewise, 2011 is a year in which maximum times the Malaysian firms are exposed to FX risk against all currencies. In contrast, 2013 is year in which the least number of times the Malaysian firms are exposed to FX risk against all currencies.

4.3.5.1 Sensitivity of Individual Currencies' Exposure in Stage-two Model

In previous section, daily FX exposure of Malaysian firms is estimated against five different currencies, however, it is to be further examined to what extent FCDs use is explained by the exposures of these currencies as well as their impact on the results of other explanatory variables is also tested. Table 4.18 presents the results of stage-two model separately estimated for each individual currency. φ_{it}^{USGAJ} is the sensitivity of stock returns to any one of the five currencies after being transformed by taking square root of absolute values of each individual currency's coefficients.

Results show that the sensitivity of USD and JPY among all currencies is considerably high in determining the use of FCDs. Both currencies are highly statistically significant in the model with the negative sign of their coefficients. This indicates that the propensity of Malaysian firms towards the use of FCDs increases as foreign currency exposure decreases.

In contrary, SGD, GBP and AUD are observed as insignificant in the model which implies that firms' hedging pattern remains unaffected either by the appreciation or depreciation of these currencies. Finally, the inclusion of these five currencies in the model does not significantly affect the results of other explanatory variables.

Table 4.18
Results of stage-two model estimated separately for each currency

Predictor	φ^{USD}	φ^{SGD}	φ^{GBP}	φ^{AUD}	φ^{JPY}
Constant	-7.773	-8.315	-8.264	-8.471	-7.872
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
φ^{USGAJ}	-0.657	-0.133	-0.233	-0.071	-.830
	(0.000)***	(0.367)	(0.333)	(0.765)	(0.001)***
RMC	0.161	0.133	0.129	0.133	0.129
	(0.191)	(0.278)	(0.290)	(0.277)	(0.294)
CAPEX (%)	-0.003	-0.001	-0.001	-0.001	-0.002
	(0.854)	(0.932)	(0.943)	(0.952)	(0.896)
MTBV	0.117	0.111	0.110	0.117	0.129
	(0.299)	(0.323)	(0.328)	(0.297)	(0.251)
INCOV	0.007	0.009	0.009	0.009	0.008
	(0.104)	(0.046)**	(0.050)**	(0.038)**	(0.069)*
LVRG	3.147	3.061	3.067	3.066	3.122
	(0.008)***	(0.010)***	(0.010)***	(0.010)***	(0.009)***
SIZE	0.521	0.534	0.531	0.540	0.524
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
FSTS (%)	0.010	0.010	0.010	0.010	0.010
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
LIQ	-0.015	-0.004	-0.005	-0.003	-0.014
	(0.753)	(0.926)	(0.919)	(0.955)	(0.765)

*** significant at 1%, ** significant at 5%, * significant at 10% All figures in parenthesis are *p*-values.

This table presents the result summary (with estimated coefficients and *p*-values) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for a sample of 224 nonfinancial firms over the period of 2008 to 2014. The model is separately estimated for each currency along with other explanatory variables. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^{USGAJ} + \alpha_2 RMC_{it} + \alpha_3 CAPEX_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^{USGAJ} is the square root of the absolute value of each currency exposure coefficient estimated through exposure model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX represents the capital expenditures as a percentage of total sales; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

4.3.6 Alternative Empirical Measures

In main analysis, that measurements of explanatory variables are selected that are commonly used by previous studies. However, the investigation of how sensitive study results are to alternate measurements is necessary. Therefore, robustness of results is tested by using alternative empirical proxies for some of the explanatory variables such as CAPEX, SIZE and LIQ.

4.3.6.1 Alternative Measurement for Underinvestment

In main analysis, CAPEX is used to test the underinvestment hypothesis that hedging increases firm's incentive to positive NPV investment. However, several studies (for example, Clark & Judge, 2008; Gay & Nam, 1998; Hu & Wang, 2005) use alternative measures to capture firm's ability to capitalize investment opportunity such as price-earnings ratio (PER). Therefore, by following these studies, PER (measured as share price divided by earnings per share in relevant year) is used as an alternate measure for underinvestment hypothesis to check robustness of results.

Results after using PER as an alternative measure for underinvestment hypothesis are illustrated in Table 4.19. PER is not statistically significant (α_3 = 0.005, *p*-value = 0.535) and thus underinvestment hypothesis is not supported by the mean of this alternative measure, hence alternative hypothesis (H_4) remains rejected. This suggests that there is no impact on the pattern of derivative use of Malaysian firms by using either measure of underinvestment. Furthermore, obtained results of other explanatory variables are also

remains unchanged by the use of PER with exception of INCOV which is now statistically significant at 10% (α_2 = 0.007, *p*-value = 0.097). Findings of PER is consistent with Charumathi and Kota (2012), Clark and Judge (2008), Gay and Nam (1998) and Hu and Wang (2005) who also find that PER is insignificant in relation with derivative use.

Table 4.19
Results summary of stage-two model after using PER for underinvestment hypothesis

Predictor	**Coefficient Estimate**	***P-value***	**Odds Ratios**	**Std. Error**
Constant	-8.616	0.0000***	0.000	0.795
φ^D	-0.522	0.002***	0.593	0.170
RMC	0.140	0.2500	1.151	0.122
PER	**0.005**	**0.561**	**1.005**	**0.009**
MTBV	0.107	0.342	1.125	0.113
INCOV	0.007	0.097*	1.009	0.004
LVRG	3.071	0.0090***	21.559	1.175
SIZE	0.551	0.0000***	1.735	0.063
FSTS (%)	0.010	0.0000***	1.010	0.002
LIQ	-0.005	0.750	0.995	.047

*** significant at 1%, ** significant at 5%, * significant at 10%

This table presents the result summary (with estimated coefficients, p-values, Odds ratios and standard error) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014 by using alternate empirical measurement for CAPEX variable. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^D + \alpha_2 RMC_{it} + \alpha_3 PER_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; PER measured as share price divided by earnings per share in relevant year; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is the log of firms' total assets; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

4.3.6.2 Alternative Measurement for Firm's Size

Initially the hypothesis regarding firm's size, that large size firms are more inclined towards the use of hedging instruments than smaller firms, is tested by taking the log of total assets. Some studies, such as Purnanandam (2008), Kapitsinas (2008) and Schiozer and Saito (2009), use alternate proxy for firm size by taking the log of total sales in each year. By following them, therefore, current study uses log of total sales as an alternate empirical measure for firm size to capture the well-known size effects in derivative usage.

Results are tabulated in Table 4.20 where SIZE is measured as a log of total sales. Even in alternative measurement, SIZE remained strongly significant ($\alpha_8 = 0.749$, p-value < 0.01) while odds ratio indicating that as the size will increase by one unit, the likelihood of using FCDs will increase by 2.115 times. This finding confirms size hypothesis (H_8) that larger firms get more incentives from hedging. In addition to that, alternate size measurement affects the results of other explanatory variables as well. RMC, for example, now becomes statistically significant at 10% level ($\alpha_8 = 0.232$, p-value = 0.055), and INCOV becomes statistically insignificant ($\alpha_8 = 0.005$, p-value = 0.301), indicating that the use of alternate measurement of firm's size has considerable influence on other variables. Nevertheless, obtained results related to SIZE are in line with Purnanandam (2008) and Clark and Mefteh (2010) who also find significant positive impact of firm's size on derivative use.

Table 4.20
Results summary of stage-two model after using log of total sales for size hypothesis

Predictor	**Coefficient Estimate**	***P-value***	**Odds Ratios**	**Std. Error**
Constant	-11.066	0.0000***	0.000	1.006
φ^D	-0.472	0.006***	0.624	0.172
RMC	0.232	0.0550*	1.262	0.121
CAPEX	0.018	0.285	1.018	0.015
MTBV	0.107	0.377	1.113	0.112
INCOV	0.005	0.301	1.006	0.005
LVRG	3.793	0.001***	44.394	1.189
SIZE	**0.749**	**0.0000*** **	**2.115**	**0.080**
FSTS (%)	0.008	0.001***	1.008	0.002
LIQ	0.013	0.974	1.013	0.048

*** significant at 1%, ** significant at 5%, * significant at 10%,

This table presents the result summary (with estimated coefficients, p-values, Odds ratios and standard error) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014 by using alternate empirical measurement for SIZE variable. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^D + \alpha_2 RMC_{it} + \alpha_3 PER_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX measured as capital expenditure to total sales ratio; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is log of total sales; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as current assets of a firm scaled by current liabilities; and finally, μ is the residual of binary logistic regression model.

4.3.6.3 Alternative Measurement for Liquidity

In main analysis, the behavior of Malaysian firms regarding the use of FCDs is tested against liquidity by using the measurement of current ratio. However, for some studies (such as, Bartram et al., 2011; Bartram et al., 2009; Shaari et al., 2013; Sprcic & Sevic, 2012) quick ratio has been a preferred measure of liquidity while estimating determinants of financial derivatives. By following these studies, current study also uses quick ratio[26] as an alternate measurement for liquidity to check result robustness.

Results of stage-two model, after using quick ratio as proxy of liquidity, are depicted in Table 4.21. As evident from the table that use of quick ratio does not support liquidity hypothesis and appeared statistically insignificant (α_{10} = -0.097, *p*-value = 0.132) indicating that level of liquidity of Malaysian firms has no relation with the use of financial derivatives. Use of this alternate measurement does not have any impact on other variables as well, since results of other explanatory variables remain unchanged. Nonetheless, result of liquidity with quick ratio is consistent with Shaari et al. (2013), Sprcic and Sevic (2012) and Howton and Perfect (1998) who also find insignificant relationship between quick ratio and usage of hedging instruments.

[26] Measured as (Cash & Equivalents + Receivables (Net)) / Total Current Liabilities

Table 4.21
Results summary of stage-two model after using quick ratio for liquidity hypothesis

Predictor	**Coefficient Estimate**	***P-value***	**Odds Ratios**	**Std. Error**
Constant	-8.293	0.0000***	0.000	0.788
φ^D	-0.542	0.001*	0.582	.170
RMC	0.146	0.232	1.158	.122
CAPEX (%)	-0.001	0.829	0.999	.015
MTBV	0.133	0.264	1.143	0.112
INCOV	0.010	0.043**	1.010	0.004
LVRG	2.818	0.018**	16.747	1.188
SIZE	0.539	0.0000***	1.715	0.063
FSTS (%)	0.010	0.0000***	1.010	0.002
LIQ	**-0.097**	**0.132**	**0.919**	**0.064**

*** significant at 1%, ** significant at 5%, * significant at 10%

This table presents the result summary (with estimated coefficients, p-values, Odds ratios and standard error) of the explanatory variables used in stage-two model which estimates the propensity of Malaysian firms towards the use of FCDs for the sample of 224 nonfinancial firms over the period of 2008 to 2014 by using alternate empirical measurement for SIZE variable. The stage-two model is: $FCD_{it} = \alpha_0 + \alpha_1 \varphi_{it}^D + \alpha_2 RMC_{it} + \alpha_3 PER_{it} + \alpha_4 MTBV_{it} + \alpha_5 INCOV_{it} + \alpha_6 LVRG_{it} + \alpha_7 SIZE_{it} + \alpha_8 FSTS_{it} + \alpha_9 LIQ_{it} + \mu_{it}$, where FCD is a binary dependent variable which assigned a value of '0' if firm is a non-user of FCDs and '1' otherwise; φ_{it}^D is the square root of the absolute value of each β_1 estimated in stage-one model; RMC is a dummy variable which equals to '1' if firm has RMC and '0' otherwise; CAPEX measured as capital expenditure to total sales ratio; MTBV measured as a ratio of market value and book value of a firm; INCOV refers to the amount of earnings before interest and tax scaled by interest expense; LVRG is the amount of long-term debt deflated by total assets; SIZE is log of total sales; FSTS is the foreign sales as a percentage of total sales; LIQ is measured as quick ratio; and finally, μ is the residual of binary logistic regression model.

To be in line with previous studies, this study did not perform further robustness test (like heteroskedasticity and autocorrelation) based on the arguments of Sprcic and Sevic (2012). They argue that, unlike ordinary least square regression, the linear relationship between dependent and explanatory variables cannot be assumed in logistic regression model as variables does not require to be normally distributed. Homoscedasticity and error terms are

not assumed to be normally distributed and it does not require the independents to be unbounded. In general, logistic regression model has less stringent requirements.

4.4 Conclusion

This chapter provides the results and discussion related to two models. The first model estimates the FX exposure of Malaysian firms over the period of 2008 to 2014. The second model tests the effect of different factors towards the propensity to use FCDs by Malaysian firms during the sample period. For the stage-one model, descriptive statistics and summary of the coefficient of TWI (β_1) is given. It is evident that in 2011, large number of Malaysian firms is significantly exposed to exchange rate risk, while the least number of firms are exposed in 2008. Surprisingly, for the whole sample, it is also found that the significant positive coefficients of all firms outnumbered than those of negative coefficients in all years. These results confirmed first hypothesis (H_1) of the study that volatilities in exchange rates affect stock prices of Malaysian firms.

Subsequently, the results of stage-two model (logistic regression model) are presented which examines the propensity of Malaysian firms towards the use of FCDs. Some risk management theories are tested under this model like underinvestment theory and financial distress theory. Results of univariate test show that all explanatory variables significantly differ from each other with respect to FCDs usage in term of their characteristics.

Results of multivariate test exhibit that exposure to FX rate is negatively and significantly related to derivatives use. However, RMC and both proxies of underinvestment theories

are statistically insignificant indicating that there is no relationship of RMC, CAPEX and MTBV with the use of FCDs. INCOV and LVRG both are statistically significant which shows that firms in a situation of financial distress are more inclined towards the use of financial derivatives. Likewise, results regarding SIZE and FSTS support the hypothesis that large firms and firms doing cross border trade are inclined to use FCDs to mitigate their currency exposure. Finally, results for liquidity provide no support for the hypothesis that low liquid firms use derivatives to mitigate their financial risk.

Robustness analysis is performed in the study by several ways. First, the sensitivity of SIZE variable is tested by omitting it from stage-two model and find that SIZE co-opts the explanatory power of the RMC, MTBV and LIQ. Second, the dichotomous measurement was taken for β_1 (coefficient of FX rate exposure) and re-estimated in stage-two model to check its effect on other variables' results. No significant changes are found in results. Third, the sensitivity of market portfolio index in exposure model is tested by introducing Malaysian market portfolio index, i.e. FBMEMAS, in equation 3.1 (known as augmented model). It is found that the inclusion of FBMEMAS in the model substantially reduces FX exposure. Subsequently, the coefficient of that FX exposure, obtained through augmented model, is transformed and re-estimated in stage-two model, but no significant influence is found in hedging pattern of Malaysian firms due to exposure.

Fourth, the sensitivity of FX exposure to different time horizon is also tested by calculating results in two different time horizons; i.e. weekly and monthly, and found that, inconsistent to literature, exposure to currency risk decrease with the increase in time horizon. Additionally, the role of monthly and weekly exposure in determining the use of FCDs is

also tested in stage-two model and found that firm's hedging through FCDs is significantly influenced by the changes in weekly and monthly FX exposure. Fifth, the robustness across different bilateral exchange rates is also tested by using different currency pairs and results show that USD and JPY yield maximum exposure to Malaysian firms over the sample period. Moreover, the role of each currency exposure is tested through stage-two model in explaining the use of FCDs by Malaysian firms and results indicate that USD and JPY significantly determine the use of FCDs. Finally, three alternative measures; PER, log of total sales, quick ratio; are used in stage-two model for underinvestment, size and liquidity hypothesis respectively to check result robustness. PER and quick ratio are insignificant but the log of total sales is statistically significant.

Chapter 5 CONCLUSION AND RECOMMENDATION

5.0 Introduction

This chapter provides the conclusion of this study and is divided into four sections. The first section gives an overview of the research process, the second section summarizes the findings, the third section discusses the contributions and implications, and finally, the fourth section provides the limitations and recommendations for the future research.

5.1 Overview of Research Process

Volatilities in FX rates influence the profitability and value of a firm that involve in international trade and also bring uncertainty in an economy at macroeconomic level. Persistent variations in foreign exchange rate affect firm's cash flows as well as discount rates used to value these cashflows. This subject has spawned an adequate amount of research in the area of FX exposure focusing on developed economies like USA, UK and Australia and the dearth of research on developing economies motivates the author to carry out this study on Malaysian economy to investigate the effect of FX rate fluctuations on Malaysian firms. The first objective of this study is, therefore, to investigate the impact of exchange rate volatilities on firm's stock returns in Malaysia.

Corporate risk management has been an interest of financial managers, accountants, auditors, investors and academicians. Theoretical and empirical research on derivative financial instruments has developed rapidly since the 1980s and considerable amount of research in literature related to hedging has been done so far. One main stream of this

research has tested the empirical clarifications for corporate risk management by investigating the factors that drive the use of FCDs (see Géczy et al., 1997; Hagelin, 2003; Judge, 2006b; Nguyen & Faff, 2002). A notable limitation of this substantial body of international empirical research is the absence of consistent evidence on the hypothesized determinants of the decision to hedge. This limitation warrants further investigation on the determinants of hedging instruments and motivate the author to undertake this study. Therefore, the second objective of this study is to contribute to the empirical literature by examining the factors that drive firms towards the use of hedging instruments.

The model of Adler and Dumas (1984) is, therefore, selected to achieve first research objective of the study in which the returns on a firm's stock are regressed on the changes in FX rate by using ordinary least square model, where the coefficient of FX rate represents FX rate exposure. JP Morgan TWI is used as a proxy for exchange rates. As the correlation between nominal and real exchange rates of JP Morgan TWI over the period is high, therefore, the study considers nominal values for the selected market portfolio index.

Similarly, to achieve the second objective, logistic regression model is used to test the propensity of Malaysian firms towards the use of FCDs. Several risk management theories are tested along with different hedging factors in relation to derivatives' use. For example, the role of FX rate risk in determining the use of FCDs is tested by taking the coefficient of TWI (estimated from exposure model) as an explanatory variable. Similarly, the extent to which FCDs are used by firms due to the presence of risk management committee (RMC) is also investigated in same model. Underinvestment theory is tested by using two proxies; capital expenditure ratio (CAPEX) and market-to-book value ratio (MTBV).

Similarly, financial distress theory is tested in the model by selecting two proxies; interest coverage ratio (INCOV) and leverage ratio (LVRG). Likewise, size hypothesis is tested by taking the natural log of total assets (SIZE). The conjecture about firm's market openness, i.e., firms with larger foreign business operations are more likely to use derivatives, is tested by using foreign sales ratio (FSTS). Finally, the liquidity hypothesis, i.e., highly liquid firms are less likely to inclined towards hedging, is tested by using current ratio (LIQ).

As this study is conducted on Malaysian economy, therefore, 224 Malaysian listed nonfinancial firms are selected. The period of the study consists of seven years starting from 2008 to 2014. Data are collected from Datastream and annual audited reports available on Malaysian stock exchange website or the respective websites of the firms.

The analysis and discussion on obtained results are sequentially performed on stage-one and stage-two model. Descriptive statistics of firm's exposure coefficient (β_1) is given followed by a summary on a direction of FX rate exposure. Subsequently, results are exhibited for stage-two model. Initially, descriptive statistics of the variables are illustrated and discussed used in stage-two model. Next, univariate analysis is conducted that explaining whether FCDs users and nonusers are different from each other with respect to their characteristics. Later, correlation between variables is determined followed by multicollinearity test by using VIF. The study proceeds with the analysis of logistic regression results that explain what factors determine the use of FCDs. The comparison of obtained results with previous studies is also performed simultaneously for stage-one and stage-two model.

Finally, the robustness of results is tested by different ways. For example, the sensitivity of SIZE variable is tested by omitting it from the stage-two model. Similarly, the measurement of β_1 is changed by assigning a value of '1' for significant and '0' for insignificant values and then it is re-estimated in stage-two model as an explanatory variable. Likewise, the sensitivity of market portfolio index is examined by introducing Malaysian market index, i.e. FBMEMAS, in stage-one model. After that, the obtained estimated coefficient of TWI (γ_3) is re-estimated in stage-two model to examine its impact on FCDs use. Similarly, the sensitivity of FX exposure to different return horizons is tested. FX exposure of Malaysian firms is re-estimated over the sample period by using monthly and weekly return data for firm's stock and TWI. Afterwards, the estimated weekly and monthly FX exposure coefficients are re-estimated in stage-two model as an explanatory variable to investigate the extent to which weekly and monthly FX exposure determine the use of FCDs by Malaysian firms. In the same way, different bilateral exchange rates are used to check the sensitivity of currency exposure and, subsequently, their impact on FCDs adoption is also investigated through stage-two model. Finally, alternative measurements for different variables (like underinvestment theory, size hypothesis and liquidity hypothesis) are employed to check their impact on results of other explanatory variables.

5.2 Summary of Findings

Initially, the FX rate exposure of Malaysian firms is estimated through exposure model over the period of 2008 to 2014 by using daily returns. The results show that 37% of the firms (586 firm-year observations) are exposed to FX rate changes at a 5% level of significance during sample period. Furthermore, firms with positive β_1 are more than

quadruple the firms with negative β_1 over the study period. The dominance of Malaysian firms with positive β_1 in each year implies that most of the Malaysian firms in the sample are net-exporters.

The sensitivity of FX exposure to weekly and monthly horizons is also estimated by using exposure model. Results run counter to the conjecture which states that exposure to exchange rate risk increases as the time horizon increases. FX exposure reduced by using weekly and monthly horizons as only 20% of total firms (316 firm-year observations) at weekly horizon and 10% of total firms (163 firm-year observations) at monthly horizons are significantly exposed to exchange rate changes at 5% level. These results provide evidence that Malaysian firms' FX exposure increase as time horizon decreases and, confirm the first hypothesis (H_1) that volatilities in exchange rates affect stock prices of Malaysian firms.

The sensitivity of market portfolio index is tested in exposure model. Malaysian market index, i.e., FBMEMAS, is added in the stage-one model and FX exposure for Malaysian firms is estimated over the sample period. It is obvious from the results that the number of significant coefficients of market index remains surprisingly high throughout the sample period than that of TWI. A 67% of total firms (1045 firm-year observation) have significant relationship with market index over the sample period as compared to 9% (139 firm-year observations) of TWI which shows drastic decreased in FX exposure by 76%. These results confirms the argument of Dominguez and Tesar (2006), Ito et al. (2016), Priestley and Ødegaard (2002) and Bodnar and Wong (2003) that sometimes market portfolio index as

a whole become strongly correlated with exchange rate changes and, in result, it dramatically reduces FX exposure.

Although several studies (such as Allayannis & Ofek, 2001; Bodnar & Gentry, 1993; He & Ng, 1998; Nguyen et al., 2007; Zhou & Wang, 2013) use relevant TWI in their studies, however, some other studies, like De Jong et al. (2006), Nguyen and Faff (2003a), Williamson (2001) and Dominguez and Tesar (2006), are in favor of using bilateral exchange rates based on several competing arguments. Therefore, FX exposure of Malaysian firms is re-estimated at daily horizon over the sample period using five cross-currency exchange rates that are most relevant to Malaysian firms, namely the US Dollar (USD), the Singapore Dollar (SGD), the Great Britain Pound (GBP), the Australian Dollar (AUD) and the Japanese Yen (JPY). Results reveal that USD and JPY stand at the top of all currencies that give maximum exposure to Malaysian firms. On the contrary, GBP is the currency against which the least number of firms are exposed during the sample period.

In the second step, the estimated parameters of exchange rate exposure, estimated in the stage-one model, are then used in the stage-two model together with the other identified factors. Logistic regression is, therefore, employed to examine the relationship between the likelihood of using FCDs by Malaysian firms and the motivating factors that drive the demand of these hedging instruments proxied by different explanatory variables over the sample period. Results reveal that φ_{it}^{D} (daily FX rate exposure) significantly determine the use of FCDs by Malaysian firms. However, the sign of the coefficient is negative, which implies that the use of FCDs increases as the exposure to exchange rate decreases. This finding is in contrast with the exposure conjecture which states that increase in currency

exposure leads to the increase in FCDs use. Therefore, H_2 is rejected which states that FX rate exposure and FCDs use are positively related with each other.

The second explanatory variable in stage-two regression model is RMC which is found to be insignificant implying that the likelihood of using of FCDs is not explained by RMC. This rejects H_3 which states that there is a positive relation between RMC and the use of FCDs. Similarly, two proxies are selected to test underinvestment hypothesis; CAPEX and MTBV. This study finds no support for the underinvestment hypothesis as both are not associated with a higher likelihood of derivative usage. The insignificance of these variables indicates that investment and growth opportunities for Malaysian firms do not have any impact on financial derivatives' usage. This rejects H_4 and H_5 as both hypothesis states that CAPEX and MTBV, respectively, are positively associated with firm's hedging.

Financial distress cost theory is tested by two variables; INCOV and LVRG. Both are found to be significant, which indicates that financial distress firms hedge their risk through FCDs. The significance of INCOV signifies that INCOV has substantial influence on firm's hedging pattern. However, the coefficient of INCOV is observed to be positive which is inconsistent with the theory which states that financial distress firms with low ability to cover their interest cost are more likely to use derivatives. Positive relationship between INCOV and FCDs indicates that Malaysian firms use derivatives even when they are in a good position of paying their fixed cost. On the other side, LVRG results are in line with the theory that the greater the firm's leverage, the more likely the firm is to use derivatives. It is found that LVRG is positively and significantly affecting the use of FCDs, indicating that highly leveraged Malaysian firms are more likely to engage in derivative

transactions. Both hypothesis H_6 and H_7 are accepted indicating INCOV and LVRG, respectively, have a relationship with hedging through FCDs.

Size hypothesis is also tested in stage-two model and SIZE is found to be highly significant with a positive coefficient indicating that the level of FCDs usage by Malaysian firms increases with the increase in firm size; this result support H_8 which assumes a positive relationship between SIZE and FCDs. In the same way, the hypothesis about firm's market openness is also tested in stage-two model through FSTS variable and it is found highly significant with positive coefficient representing that firms with high level of foreign trade are likely to face higher level of FX exposure; therefore, more induce to use hedging instruments. This accepts H_9 which suggests the positive relationship between FSTS and FCDs. Finally, the extent to which liquidity works as a substitute of hedging for Malaysian firms is tested in empirical regression model by using a proxy, i.e. current ratio (LIQ). Results show that the level of liquidity has no influence on the firm's decision to use derivative to hedge; hence H_{10} is rejected which assumes the relationship between LIQ and FCDs.

Univariate analysis is carried out in which *t*-statistics is used to test the mean differences among firm's characteristics on a basis of FCDs users and non-users. Similarly, Pearson's correlation is employed to determine the degree of relationship among different explanatory variables. Results reveal that all correlation coefficient are below than 0.8 or 0.9 (Judge, Hill, Griffiths, Lutkepohl, & Lee, 1988). However, multicollinearity is formally tested through variance inflation factor (VIF) among all explanatory variables. If the VIF value is greater than 10, multicollinearity problem is severe. Since, none of the VIF values

exceed from 2, thus this study does not suffer from multicollinearity problem among variables.

Although daily FX exposure (φ_{it}^{D}) found to be highly significant in explaining the use of FCDs; however, the impact of weekly (φ^{W}) and monthly (φ^{M}) FX exposure on FCDs use is also investigated. It is found that both φ^{W} and φ^{M} are negatively and significantly influence the use of foreign currency hedging instruments.

As discussed earlier, the propensity of Malaysian firms towards the use of FCDs is estimated through stage-two model in main analysis. FX exposure, as an explanatory variable, is measured as the square root of the absolute values of exposure coefficient estimated from stage-one model. However, the robustness of these results is also tested by taking dichotomous (binary) measurement of β_1 ('0' for insignificant coefficient and '1' otherwise) and denoted by $\beta^{(0,1)}$. Results report that $\beta^{(0,1)}$ remains significant in the model, and the results of other variables remain unchanged.

As stated earlier, FX exposure of Malaysian firms (estimated through augmented exposure model), become considerably reduced after including market portfolio index (RM) in the model. However, the sensitivity of that exposure is also tested in stage-two model as an explanatory variable (φ^{AUG}) to check how much it explains the use of FCDs and to what extent it affects other variables. Findings indicate that φ^{AUG} is insignificant which implies that φ^{AUG} does not explain the use of FCDs by Malaysian firms. However, the inclusion of φ^{AUG} does not significantly affect the results of other explanatory variables of the model.

As discussed earlier, the stage-one model is estimated against five different bilateral exchange rates. Furthermore, the parameters of these bilateral exchange rates are used in stage-two model to examine the extent of FCDs usage. For this purpose, each currency exposure coefficient is alternatively used as a separate explanatory variable in stage-two model and its impact on FCDs is determined. It is evident from the results that USD and JPY stand out at the top among all currencies that significantly explain the use of FCDs as both are found to be highly statistically significant. The rest of the currencies, i.e., SGD, GBP and AUD, are found to be insignificant indicating that there is no impact on FCDs use from the exposure against these currencies.

Although, the correlation analysis exhibits no serious correlation between explanatory variables of stage-two model, however, the correlation coefficients between SIZE and other variables (with the exception of φ_{it}^{D}) are highly significant at 1% significance level which signifies that SIZE may have considerable influence on the significance of other explanatory variables. Therefore, the sensitivity of SIZE in stage-two model is tested by dropping it from the model. Results shows that SIZE has considerable significant influence on the results of other explanatory variables. RMC, MTBV and LIQ, that were previously insignificant, now become highly significant after omitting SIZE from the model. This suggests that SIZE co-opts the explanatory power of the RMC, MTBV and LIQ variables. Alternatively, these three variables were then dropped from the model and effect on SIZE is tested. Results show no effect on SIZE variable by the omission of RMC, MTBV and LIQ.

5.3 Contributions and Implications of the Study

This study makes contribution to the empirical literature in several ways. First, the novel contribution of this study is the inclusion of the new exogenous variable, i.e. β_1 (representing FX exposure), in stage-two model with the intention of investigating the extent to which β_1 determines the use of FCDs by Malaysian firms. Using β_1 as a separate and individual determinant of FCDs use in a model is entirely a new concept and important contribution in literature which has not been attempted before by any author. It is evident from the results that the use of FCDs is significantly explained by β_1.

Second, the current research makes valuable contribution to current vein of literature by taking into consideration another new variable 'RMC'. So far, to the best of author's knowledge, previous studies who provide international evidences on the use of derivatives on different economies, did not discuss this notion that the demand of derivative instruments may be influenced by RMC of a firm. Initially, RMC was predicted to be insignificant in the model, afterwards, its significance was re-tested by dropping SIZE from the model. Results show that RMC become highly significant after omitting SIZE which implies that level of derivatives' usage by the firms is highly explained by RMC in absence of SIZE in stage-two model.

Third, a notable contribution to the current literature is to solely explore the determinants of FCDs use. Previous studies, in Malaysian context, discussed the effect of different motivating factors of hedging by taking into consideration all types of financial derivatives instruments (i.e. FCDs, interest rate derivatives and commodity price derivatives), but this

relationship is not separately explored yet for FCDs for Malaysian firms. The intention of using each type of derivative instrument is quite different from each other, hence, exploring FCDs' determinants together with other types of derivatives may yield ambiguous and inconclusive results and factors for using each derivative instrument may remain unidentified and vague. Therefore, this study looks at the factors that solely drive the demand of FCDs and fill this literature gap.

Fourth, this study is among the earliest studies, to the best knowledge of author, who estimates FX exposure of Malaysian nonfinancial firms during the managed floating exchange rate system over the period of 2008 to 2014. Although several authors estimate currency exposure for developed economies (such as Agyei-Ampomah et al., 2013; Fraser & Pantzalis, 2004; He & Ng, 1998, for UK, US and Japan respectively) but developing economies, especially Malaysia, are under-researched. Secondly, none of the previous studies on Malaysia estimate FX exposure for the period after lifting pegged exchange rate system when exchange rate volatilities are relatively higher than that of any other period (see Section 1.2). Thus, current study bridges this gap by estimating the impact of fluctuations in exchange rates on Malaysian firm's stock returns. The results proved that Malaysian firms are highly affected by volatilities in FX rates during the sample period.

Fifth, most of the previous studies estimate residual FX exposure for different economies and few of them estimate total exposure for some economies. However, to the best of author's knowledge, no study has yet provided the deep insight into both types of exposure; total exposure and residual exposure, for Malaysian economy. This is the first study who estimates total and residual exposure for Malaysian nonfinancial firms over the sample

period. Results reveal that total exposure is 37% while residual exposure is 9% which implies that total exposure dramatically reduces by 76% as the market portfolio index is included in the exposure model.

Finally, the methodological contribution of current study regarding the estimation of FX exposure is the inclusion of new market portfolio index, i.e. FBMEMAS, in empirical exposure model to check result robustness. Most of the previous studies (such as Bacha et al., 2012; Pillay & Rangel, 2002; Ramasamy, 2000) used FBMKLCI for Malaysian economy in their exposure model, while this study used FBMEMAS, because the total numbers of constituents is 262, which is higher than 30 constituents of FBMKLCI. In line with the predictions of Bodnar and Wong (2003), Dominguez and Tesar (2006), Ito et al. (2016) and Priestley and Ødegaard (2002), results shows that FBMEMAS becomes strongly correlated with changes in exchange rate.

This study has significant practical implications for firms, investors, Bursa Malaysia Derivatives Berhad and Malaysian government. First, results reveal that USD and JPY yield high exposure respectively to Malaysian firms, therefore, managers of Malaysian firms should be careful when a firm makes international transactions in these currencies. They should formulate risk management strategies and hedging programs accordingly to control FX risk against these currencies, smooth their cash flows, improve firm's performance, and enhance firm value.

Second, the empirical results regarding FX exposure have practical implication for investors as well. The finding could assist investors to examine the sensitivity of Malaysian

stock returns to FX rate movements in making investment and financial decisions. Findings guide them that if they have invested in firms that are net-exporters then they should also invest in net-importers to offset their positive and negative FX exposure. Results should also be relevant to those investors who under or overweight large multinational firms.

Third, results have implication for Bursa Malaysia Derivatives Berhad regarding financial risk management policies for listed firms. Although current policies of Bursa Malaysia Derivatives Berhad safeguard Malaysian firms from financial risk. For example, in transactions particularly related to derivative financial instrument, Bursa Malaysia employ effective risk management process to prevent any adverse systemic impact on the market by changing initial margin requirements on hedging contracts and through the maintenance of clearing funds for counter parties of derivative transactions (Hui-Nee, 2014). However, results of this study have further implications for Bursa Malaysia Derivatives Berhad in offering new or improve existing derivative products to assist Malaysian firms in mitigating their FX exposure specially in a period of high fluctuations in FX rates.

Finally, the study findings have implications for Malaysian government as well to formulate risk management strategies at national level to safeguard domestic firms that involve in cross-border trade and small & medium enterprises from FX rate risk, so that the reduction in FX rate risk may significantly and favorably affect the GDP and national income of Malaysian economy. Moreover, Malaysian government may impose taxes on firm's income generated from hedging strategies as this policy will increase government revenues at national level.

5.4 Limitations and Recommendations for Future Research

As with all field research, this study is not without limitations. Following are some limitations of this study that have to be borne in mind as they suggest directions for future research. First, the potential limitation of the study is that the data is collected through annual audited reports and Datastream. If there is any problem related to data disclosure then that would limit the validity of the results. Future researchers are encouraged to carry out same research through survey method so that issues related to secondary data may be overcome.

Second, this study is limited to the period of 2008 to 2014. The reason for confining the study to this period is that an adequate information during this period regarding firm's risk management activities, hedging policies and derivative financial instruments are available in annual reports as firms are required to disclose such information under Financial Reporting Standard (FRS) 139. Before that period, firms are not legally bound to disclose detailed information about derivative financial instruments and annual reports are having lack of disclosure from this respect. However, future studies are suggested to estimate FX exposure and hedging determinants for longer period of time (e.g. 10 years) such as 2008 to 2018 to get more robust and generalized results.

This study is limited to only Malaysian economy. Although voluminous empirical literature provides a richer understanding regarding currency exposure and hedging determinants on developed economies like USA, UK, Australia and France, however, research on developing and emerging economies regarding the same subject is still in its

infancy. Therefore, it would be more worthwhile if future studies focus more closely to developing economies, like Thailand, Indonesia, Pakistan and India, to bridge the existing gap as it would be an important extension to the literature.

Another potential shortcoming of this empirical investigation is the use of JP Morgan TWI while measuring FX exposure. As described earlier, this index is comprised of 64 currencies and it is probable that Malaysian firms are exposed to FX risk for some of the currencies in the index while for most of the currencies they are less or no exposed. This may understate the true extent of FX exposure for Malaysian firms. Therefore, it would be more meaningful if future research uses different TWI for Malaysian economy which encompasses only those currencies in which Malaysian firms frequently trade.

The evidence on the contemporaneous effect of FX rate movements on stock returns of Malaysian firms is provided in current study. However, some authors provide evidence of the existence of lagged relationship between the returns on firm's stock and changes in FX rates. Moreover, Bodnar and Gentry (1993) also present 'lagged response hypothesis' which suggests that the noticeable response in FX rate fluctuations may not occur contemporaneously. Therefore, this missing issue warrants further investigation for the lagged relationship between the changes in exchange rate and return on Malaysian firms' stock.

The evidence of this study regarding FX exposure is limited to the firm level. However, there are some studies in empirical literature provide evidence about the fact that exposure to exchange rate movements might be an industry specific phenomenon. This phenomenon

is based on an assumption that firms within a specific industrial group share common characteristics and behavior with respect to level of imports, exports and domestic trade. Bodnar and Gentry (1993), for example, discover significant differences in FX rate exposure among different industries. They argue that movements in FX rates influence some industries differently than others, since some industries heavily rely on exports while some substantially rely on imports. Therefore, by taking the assumption that Malaysian firms' risk may be influenced by industry specific factors, future studies are encouraged to fruitfully address the industry effect on FX exposure of Malaysian firms. This will not only fill potential gap but can be also an important extension in literature.

Current study systematically investigates the determinants of derivative usage in Malaysian market. Nonetheless, it cannot be claimed that the insignificance of some of the corporate hedging hypotheses is only due to low statistical power. There is a possibility that some of the hedging proxies may not be powerful enough to fully capture the sensitivity of FCDs usage. Therefore, it can be suggested to future researchers that alternative measurements of hedging theories should be employed to test their effect on results. For underinvestment theory and theory of hedging substitute, for example, research and development expenditures and dividend payout ratio respectively can be used to check their explanatory power on corporate derivative usage.

The scope of current study is to investigates the factors that influence hedging decision of Malaysian firms regarding the use of FCDs to mitigate their currency exposure. This confinement provides avenue for future research to investigate the factors of other hedging

instruments such as interest rate derivatives and commodity price derivatives which may become a valuable contribution to literature.

REFERENCES

Abdullah, A., & Ismail, K. N. I. K. (2016). The Effectiveness of Risk Management Committee and Hedge Accounting Practices in Malaysia. *Information Journal, 19*(7B), 2971-2976.

Abdullah, M., & Chen, L. (2010). The Association Between Committees Responsible for Risk Management and the Disclosure Level of Financial Instruments Information Among Listed Companies in Malaysia,". *Unpublished Master thesis, University of Gothenburg*.

Adam, T. R., & Fernando, C. S. (2006). Hedging, speculation, and shareholder value. *Journal of Financial Economics, 81*(2), 283-309.

Adler, M., & Dumas, B. (1984). Exposure to currency risk: definition and measurement. *Financial Management*, 41-50.

Afza, T., & Alam, A. (2011). Corporate derivatives and foreign exchange risk management: A case study of non-financial firms of Pakistan. *The Journal of Risk Finance, 12*(5), 409-420.

Agyei-Ampomah, S., Mazouz, K., & Yin, S. (2013). The foreign exchange exposure of UK non-financial firms: A comparison of market-based methodologies. *International Review of Financial Analysis, 29*, 251-260.

Ahmad, N., & Haris, B. (2012). Factors for using derivatives: evidence from Malaysian non-financial companies. *Research Journal of Finance and Accounting, 3*(9), 79-87.

Akay, G. H., & Cifter, A. (2014). Exchange rate exposure at the firm and industry levels: Evidence from Turkey. *Economic Modelling, 43*, 426-434. doi: http://dx.doi.org/10.1016/j.econmod.2014.09.003

Al-Shboul, M., & Anwar, S. (2014). Foreign exchange rate exposure: Evidence from Canada. *Review of Financial Economics, 23*(1), 18-29. doi: http://dx.doi.org/10.1016/j.rfe.2013.12.001

Alkebäck, P., & Hagelin, N. (1999). Derivative usage by nonfinancial firms in Sweden with an international comparison. *Journal of International Financial Management & Accounting, 10*(2), 105-120.

Alkebäck, P., Hagelin, N., & Pramborg, B. (2006). Derivative usage by non-financial firms in Sweden 1996 and 2003: what has changed? *Managerial Finance, 32*(2), 101-114. doi: doi:10.1108/0307435061064189

Allayannis, G. (1997). *The time-variation of the exchange rate exposure: An industry analysis.* Paper presented at the 57th Annual American Finance Association Conference,(New Orleans), January.

Allayannis, G., Ihrig, J., & Weston, J. P. (2001). Exchange-rate hedging: Financial versus operational strategies. *American Economic Review, 91*(2), 391-395.

Allayannis, G., & Ofek, E. (2001). Exchange rate exposure, hedging, and the use of foreign currency derivatives. *Journal of International Money and Finance, 20*(2), 273-296.

Allayannis, G., & Weston, J. P. (2001). The use of foreign currency derivatives and firm market value. *Review of Financial Studies, 14*(1), 243-276.

Altman, E. I., & Hotchkiss, E. (2006). *Corporate financial distress and bankruptcy: Predict and avoid bankruptcy, analyze and invest in distressed debt* (Vol. 289): John Wiley & Sons.

Ameer, R. (2010). Determinants of corporate hedging practices in Malaysia. *International Business Research, 3*(2), 120.

Ameer, R., Isa, R. b. M., & Abdullah, A. b. (2011). A survey on the usage of derivatives and their effect on cost of equity capital. *The Journal of Derivatives, 19*(1), 56-71.

Amihud, Y. (1994). Exchange rates and the valuation of equity shares. *Exchange rates and corporate performance, 11*, 49-59.

Aretz, K., Bartram, S. M., & Dufey, G. (2007). Why hedge? Rationales for corporate hedging and value implications. *Journal of Risk Finance, The, 8*(5), 434-449.

Arnold, M. M., Rathgeber, A. W., & Stöckl, S. (2014). Determinants of corporate hedging: A (statistical) meta-analysis. *The Quarterly Review of Economics and Finance, 54*(4), 443-458. doi: http://dx.doi.org/10.1016/j.qref.2014.05.002

Arterian, S. (1993). Smooth sailing through currency swings. *CFO, 9*(1), 53-55.

Atindéhou, R. B., & Gueyie, J. P. (2001). Canadian chartered banks' stock returns and exchange rate risk. *Management Decision, 39*(4), 285-295. doi: doi:10.1108/EUM0000000005463

Bacha, O. I., Mohamad, A., Zain, S. R. S. M., & Rasid, M. E. S. M. (2012). Foreign exchange exposure and impact of policy switch – the case of Malaysian listed firms. *Applied Economics, 45*(20), 2974-2984. doi: 10.1080/00036846.2012.684790

Bartov, E., & Bodnar, G. M. (1994). Firm valuation, earnings expectations, and the exchange-rate exposure effect. *The Journal of Finance, 49*(5), 1755-1785.

Bartram, S. (2008). What lies beneath: Foreign exchange rate exposure, hedging and cash flows. *Journal of Banking & Finance, 32*(8), 1508-1521.

Bartram, S. M. (2000). Corporate risk management as a lever for shareholder value creation. *Financial Markets, Institutions & Instruments, 9*(5), 279-324.

Bartram, S. M. (2015). Corporate hedging and speculation with derivatives. *Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=891190*.

Bartram, S. M., Brown, G. W., & Conrad, J. (2011). The effects of derivatives on firm risk and value. *Journal of Financial and Quantitative Analysis, 46*(04), 967-999.

Bartram, S. M., Brown, G. W., & Fehle, F. R. (2009). International Evidence on Financial Derivatives Usage. *Financial Management, 38*(1), 185-206. doi: 10.1111/j.1755-053X.2009.01033.x

Bashir, H., Sultan, K., & Jghef, O. K. (2013). Impact of Derivatives Usage on Firm Value: Evidence from Non Financial Firms of Pakistan. *Journal of Management Research, 5*(4), 108-127.

Bates, E. W., & Leclerc, R. J. (2009). Boards of directors and risk committees. *The Corporate Governance Advisor, 17*(6), 16-18.

Baur, D. G., & Miyakawa, I. (2014). No puzzle: The foreign exchange exposure of Australian firms. *International Review of Financial Analysis, 32*, 13-22. doi: http://dx.doi.org/10.1016/j.irfa.2013.12.007

Belsley, D. A., Kuh, E., & Welsch, R. E. (1980). *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity*. New York, NY: John Wiley.

Berkman, H., & Bradbury, M. E. (1996). Empirical evidence on the corporate use of derivatives. *Financial Management*, 5-13.

Berkman, H., Bradbury, M. E., Hancock, P., & Innes, C. (2002). Derivative financial instrument use in Australia. *Accounting & Finance, 42*(2), 97-109. doi: 10.1111/1467-629X.00069

Bhagawan, P., & Lukose, J. (2014). *The Determinants of Firms' Currency Derivatives Usage: A Panel Data Analysis*. Paper presented at the World Finance Conference, Venice.

Bhuiya, M., Islam, I., Ahmed, E., & Haque, M. (2015). 'Corporate International Diversification, Exchange Rate Exposure, and Firm Value'An Analysis on United

Kingdom Multinationals. *International Journal of Economics, Commerce and Management, 3*(3).

Bodnar, G. M., & Gentry, W. M. (1993). Exchange rate exposure and industry characteristics: evidence from Canada, Japan, and the USA. *Journal of International Money and Finance, 12*(1), 29-45.

Bodnar, G. M., Giambona, E., Graham, J. R., & Harvey, C. R. (2016). A view inside corporate risk management.

Bodnar, G. M., & Wong, M. F. (2003). Estimating exchange rate exposures: Issues in model structure. *Financial Management*, 35-67.

Bredin, D., & Hyde, S. (2011). Investigating sources of unanticipated exposure in industry stock returns. *Journal of Banking & Finance, 35*(5), 1128-1142. doi: http://dx.doi.org/10.1016/j.jbankfin.2010.09.029

Calderón, C., Loayza, N., & Schmidt-Hebbel, K. (2005). *Does openness imply greater exposure*. Policy Research Working Paper; No. 3733. Washington, DC. © World Bank. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/8645/wps3733.pdf?sequence=1&isAllowed=y

Carter, D. A., Rogers, D. A., & Simkins, B. J. (2006). Does hedging affect firm value? Evidence from the US airline industry. *Financial Management, 35*(1), 53-86.

Chaieb, I., & Mazzotta, S. (2013). Unconditional and conditional exchange rate exposure. *Journal of International Money and Finance, 32*, 781-808. doi: http://dx.doi.org/10.1016/j.jimonfin.2012.07.001

Chalmers, K. (2001). The progression from voluntary to mandatory derivative instrument disclosures–Look who's talking. *Australian Accounting Review, 11*(23), 34-44.

Chamberlain, S., Howe, J. S., & Popper, H. (1997). The exchange rate exposure of U.S. and Japanese banking institutions. *Journal of Banking & Finance, 21*(6), 871-892. doi: https://doi.org/10.1016/S0378-4266(97)00002-2

Charumathi, B., & Kota, H. B. (2012). On the Determinants of Derivative Usage by Large Indian Non-financial Firms. *Global Business Review, 13*(2), 251-267. doi: 10.1177/097215091201300205

Chaudhry, D., Iqbal, N., Mehmood, M. S., & Mehmood, A. (2014). Determinants of corporate hedging policies and derivatives usage in risk management practices of non-financial firms. *Wulfenia Journal, 21*(7), 293-310.

Chen, J., & King, T.-H. D. (2014). Corporate hedging and the cost of debt. *Journal of Corporate Finance, 29*, 221-245. doi: http://dx.doi.org/10.1016/j.jcorpfin.2014.09.006

Chen, J., Naylor, M., & Lu, X. (2004). Some insights into the foreign exchange pricing puzzle: Evidence from a small open economy. *Pacific-Basin Finance Journal, 12*(1), 41-64. doi: http://dx.doi.org/10.1016/S0927-538X(03)00020-9

Chen, N.-F., Roll, R., & Ross, S. A. (1986). Economic forces and the stock market. *Journal of Business*, 383-403.

Chiao, C., & Hung, K. (2000). Exchange-Rate Exposure of Taiwanese Exporting Firms. *Review of Pacific Basin Financial Markets and Policies, 03*(02), 201-233. doi: doi:10.1142/S0219091500000133

Choi, J. J., Mao, C. X., & Upadhyay, A. D. (2013). Corporate Risk Management under Information Asymmetry. *Journal of Business Finance & Accounting, 40*(1-2), 239-271. doi: 10.1111/jbfa.12008

Choi, J. J., & Prasad, A. M. (1995). Exchange risk sensitivity and its determinants: a firm and industry analysis of US multinationals. *Financial Management*, 77-88.

Chong, L.-L., Chang, X.-J., & Tan, S.-H. (2014). Determinants of corporate foreign exchange risk hedging. *Managerial Finance, 40*(2), 176-188. doi: doi:10.1108/MF-02-2013-0041

Chow, E. H., & Chen, H.-L. (1998). The determinants of foreign exchange rate exposure: Evidence on Japanese firms. *Pacific-Basin Finance Journal, 6*(1), 153-174.

Chow, E. H., Lee, W. Y., & Solt, M. E. (1997a). The economic exposure of U.S. multinational firms. *Journal of Financial Research, 20*(2), 191-210. doi: 10.1111/j.1475-6803.1997.tb00244.x

Chow, E. H., Lee, W. Y., & Solt, M. E. (1997b). The Exchange-Rate Risk Exposure of Asset Returns. *The Journal of Business, 70*(1), 105-123.

Chowdhry, B., & Howe, J. T. (1999). Corporate risk management for multinational corporations: Financial and operational hedging policies. *Review of Finance, 2*(2), 229-246.

Clark, E., & Judge, A. (2008). The Determinants of Foreign Currency Hedging: Does Foreign Currency Debt Induce a Bias? *European Financial Management, 14*(3), 445-469. doi: 10.1111/j.1468-036X.2007.00360.x

Clark, E., & Mefteh, S. (2010). Foreign Currency Derivatives Use, Firm Value and the Effect of the Exposure Profile: Evidence from France. *International Journal of Business, 15*(2), 183.

Culp, C. L., & Miller, M. H. (1995). Metallgesellschaft and the economics of synthetic storage. *Journal of applied corporate finance, 7*(4), 62-76.

Danthine, J. P., & Donaldson, J. B. (2002). *Intermediate Financial Theory*: Prentice Hall.

De Jong, A., Ligterink, J., & Macrae, V. (2006). A Firm-Specific Analysis of the Exchange-Rate Exposure of Dutch Firms. *Journal of International Financial Management & Accounting, 17*(1), 1-28. doi: 10.1111/j.1467-646X.2006.00119.x

Di Iorio, A., & Faff, R. (2000). An analysis of asymmetry in foreign currency exposure of the Australian equities market. *Journal of Multinational Financial Management, 10*(2), 133-159.

Dominguez, K. M. E., & Tesar, L. L. (2001). *A re-examination of exchange rate exposure*. National Bureau of Economic Research.

Dominguez, K. M. E., & Tesar, L. L. (2006). Exchange rate exposure. *Journal of International Economics, 68*(1), 188-218. doi: http://dx.doi.org/10.1016/j.jinteco.2005.01.002

Du, D., Hu, O., & Wu, H. (2014). Emerging market currency exposure: Taiwan. *Journal of Multinational Financial Management, 28*(0), 47-61. doi: http://dx.doi.org/10.1016/j.mulfin.2014.10.001

Eiteman, D. K., Stonehill, A. I., & Moffett, M. H. (2007). *Multinational business finance*: Pearson/Addison-Wesley.

El-Masry, A., & Abdel-Salam, O. (2007). Exchange rate exposure: do size and foreign operations matter? *Managerial Finance, 33*(9), 741-765.

El-Masry, A., Abdel-Salam, O., & Alatraby, A. (2007). The exchange rate exposure of UK non-financial companies. *Managerial Finance, 33*(9), 620-641. doi: doi:10.1108/03074350710776217

Elliott, W. B., Huffman, S. P., & Makar, S. D. (2003). Foreign-denominated debt and foreign currency derivatives: complements or substitutes in hedging foreign currency risk? *Journal of Multinational Financial Management, 13*(2), 123-139. doi: https://doi.org/10.1016/S1042-444X(02)00039-7

Fauver, L., & Naranjo, A. (2010). Derivative usage and firm value: The influence of agency costs and monitoring problems. *Journal of Corporate Finance, 16*(5), 719-735. doi: http://dx.doi.org/10.1016/j.jcorpfin.2010.09.001

Fazillah, M., Hui, T., & Azizan, N. (2008). *The relationship between hedging through forwards, futures & swaps and corporate capital structure in Malaysia.* Paper presented at the Second Singapore International Conference on Finance.

Fok, R. C. W., Carroll, C., & Chiou, M. C. (1997). Determinants of corporate hedging and derivatives: A revisit. *Journal of Economics and Business, 49*(6), 569-585. doi: http://dx.doi.org/10.1016/S0148-6195(97)00040-4

Fornés, G., & Cardoza, G. (2009). Foreign exchange exposure in emerging markets: A study of Spanish companies in Latin America. *International Journal of Emerging Markets, 4*(1), 6-25. doi: doi:10.1108/17468800910931643

Fraser, S. P., & Pantzalis, C. (2004). Foreign exchange rate exposure of US multinational corporations: a firm-specific approach. *Journal of Multinational Financial Management, 14*(3), 261-281. doi: http://dx.doi.org/10.1016/j.mulfin.2003.07.008

Friberg, R., & Nydahl, S. (1999). Openness and the exchange rate exposure of national stock markets. *International Journal of Finance & Economics, 4*(1), 55-62. doi: 10.1002/(SICI)1099-1158(199901)4:1<55::AID-IJFE90>3.0.CO;2-1

Froot, K. A., Scharfstein, D. S., & Stein, J. C. (1993). Risk Management: Coordinating Corporate Investment and Financing Policies. *The Journal of Finance, 48*(5), 1629-1658.

Froot, K. A., Scharfstein, D. S., & Stein, J. C. (1994). A framework for risk management. *Harvard Business Review, 72*(6), 91-&.

Gatopoulos, G., & Loubergé, H. (2013). Combined use of foreign debt and currency derivatives under the threat of currency crises: The case of Latin American firms. *Journal of International Money and Finance, 35*, 54-75.

Gay, G. D., & Nam, J. (1998). The underinvestment problem and corporate derivatives use. *Financial Management*, 53-69.

Géczy, C., Minton, B. A., & Schrand, C. (1997). Why firms use currency derivatives. *The Journal of Finance, 52*(4), 1323-1354.

Graham, J. R., & Rogers, D. A. (2000). Does corporate hedging increase firm value? An empirical analysis. *Unpublished paper*.

Graham, J. R., & Rogers, D. A. (2002). Do firms hedge in response to tax incentives? *The Journal of Finance, 57*(2), 815-839.

Guay, W., & Kothari, S. P. (2003). How much do firms hedge with derivatives? *Journal of Financial Economics, 70*(3), 423-461.

Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics* (5 ed.): McGraw-Hill Irwin.

Hagelin, N. (2003). Why firms hedge with currency derivatives: an examination of transaction and translation exposure. *Applied Financial Economics, 13*(1), 55-69.

Hakala, J., & Wystup, U. (2002). *Foreign Exchange Risk; Models, Instruments and Strategies*: Risk Boots.

Hardwick, P., & Adams, M. (1999). The determinants of financial derivatives use in the United Kingdom life insurance industry. *Abacus, 35*(2), 163-184.

Hassan, M. S., Salleh, N. M., Yatim, P., & Rahman, M. R. C. A. (2012). Risk management committee and financial instrument disclosure. *Asian journal of Accounting and governance, 3*, 13-28.

Hau, H. (2002). Real Exchange Rate Volatility and Economic Openness: Theory and Evidence. *Journal of Money, Credit and Banking, 34*(3), 611-630. doi: 10.2307/3270734

Haushalter, G. D. (2000). Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers. *The Journal of Finance, 55*(1), 107-152. doi: 10.1111/0022-1082.00202

He, J., & Ng, L. K. (1998). The Foreign Exchange Exposure of Japanese Multinational Corporations. *The Journal of Finance, 53*(2), 733-753. doi: 10.1111/0022-1082.295575

Hekman, C. R. (1985). A financial model of foreign exchange exposure. *Journal of International Business Studies*, 83-99.

Hentschel, L., & Kothari, S. P. (2001). Are corporations reducing or taking risks with derivatives? *Journal of Financial and Quantitative Analysis, 36*(01), 93-118.

Hodgson, A. (1999). *Derivatives and their application to insurance: a retrospective and prospective overview*. Paper presented at the The Changing Risk Landscape: Implications for Insurance Risk Management. Proceeding of a conference sponsored by Aon Group Australia Limited.

Hosmer, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied Logistic Regression* (3 ed.). Hoboken, NJ: John Wiley & Sons.

Howell, D. C. (2016). *Fundamental statistics for the behavioral sciences*. New York, NY: Nelson Education.

Howton, S. D., & Perfect, S. B. (1998). Currency and interest-rate derivatives use in US firms. *Financial Management*, 111-121.

Hu, C., & Wang, P. (2005). The Determinants of Foreign Currency Hedging–Evidence from Hong Kong Non-Financial Firms. *Asia-Pacific Financial Markets, 12*(1), 91-107. doi: 10.1007/s10690-006-9014-9

Hui-Nee, A. (2014). *Risk management in Malaysian commercial banks.* Paper presented at the The UUM international conference on governance.

Hutson, E., & Laing, E. (2014). Foreign exchange exposure and multinationality. *Journal of Banking & Finance, 43*(0), 97-113. doi: http://dx.doi.org/10.1016/j.jbankfin.2014.03.002

Hutson, E., & O'Driscoll, A. (2010). Firm-level exchange rate exposure in the Eurozone. *International Business Review, 19*(5), 468-478. doi: http://dx.doi.org/10.1016/j.ibusrev.2009.02.007

Hutson, E., & Stevenson, S. (2010). Openness, Hedging Incentives and Foreign Exchange Exposure: A Firm-Level Multi-Country Study. *Journal of International Business Studies, 41*(1), 105-122. doi: 10.2307/27752480

Ito, T., Koibuchi, S., Sato, K., & Shimizu, J. (2015). Exchange rate exposure and risk management: The case of japanese exporting firms. doi: 10.3386/w21040

Ito, T., Koibuchi, S., Sato, K., & Shimizu, J. (2016). Exchange rate exposure and risk management: The case of Japanese exporting firms. *Journal of the Japanese and International Economies, 41*, 17-29. doi: http://dx.doi.org/10.1016/j.jjie.2016.05.001

Jalilvand, A. (1999). Why Firms Use Derivatives: Evidence from Canada. *Canadian Journal of Administrative Sciences / Revue Canadienne des Sciences de l'Administration, 16*(3), 213-228. doi: 10.1111/j.1936-4490.1999.tb00197.x

Jang, J., & Fu, G. (2008). Transform approach for operational risk modeling: value-at-risk and tail conditional expectation. *Journal of Operational Risk, 3*(2), 45-61.

Jorion, P. (1990). The exchange-rate exposure of US multinationals. *Journal of Business*, 331-345.

Joseph, N. L., & Hewins, R. D. (1997). The Motives for Corporate Hedging among UK Multinationals. *International Journal of Finance & Economics, 2*(2), 151-171. doi: 10.1002/(SICI)1099-1158(199704)2:2<151::AID-IJFE41>3.0.CO;2-N

Judge, A. (2006a). The determinants of foreign currency hedging by UK non-financial firms. *Multinational Finance Journal, 10*(1&2), 1-41.

Judge, A. (2006b). Why and How UK Firms Hedge. *European Financial Management, 12*(3), 407-441. doi: 10.1111/j.1354-7798.2006.00326.x

Judge, G. G., Hill, R. C., Griffiths, W., Lutkepohl, H., & Lee, T. C. (1988). *Introduction to the Theory and Practice of Econometrics* (2nd ed.). New York, NY: John Wiley & Sons.

Kapitsinas, S. (2008). The Impact of Derivatives Usage on Firm Value: Evidence from Greece.

Karpinsky, A. (1998). The risky business of risk management: derivatives disasters revisited [Series of two parts] Part 1. *Australian Banker (Melbourne), 112*(2), 60.

Khoo, A. (1994). Estimation of foreign exchange exposure: an application to mining companies in Australia. *Journal of International Money and Finance, 13*(3), 342-363. doi: http://dx.doi.org/10.1016/0261-5606(94)90032-9

Khumawala, S., Ranasinghe, T., & Yan, C. J. (2016). Why hedge? Extent, nature, and determinants of derivative usage in U.S. municipalities. *Journal of Accounting and Public Policy, 35*(3), 303-325. doi: http://dx.doi.org/10.1016/j.jaccpubpol.2015.12.004

Kim, J.-H., & Kim, J. (2015). Financial Regulation, Exchange Rate Exposure, and Hedging Activities: Evidence from Korean Firms. *Emerging Markets Finance and Trade*, 1-22. doi: 10.1080/1540496X.2014.998893

Kiymaz, H. (2003). Estimation of foreign exchange exposure: an emerging market application. *Journal of Multinational Financial Management, 13*(1), 71-84. doi: http://dx.doi.org/10.1016/S1042-444X(02)00034-8

Koutmos, G., & Martin, A. D. (2007). Modeling time variation and asymmetry in foreign exchange exposure. *Journal of Multinational Financial Management, 17*(1), 61-74. doi: http://dx.doi.org/10.1016/j.mulfin.2006.03.004

Leland, H. E. (1998). Agency costs, risk management, and capital structure. *The Journal of Finance, 53*(4), 1213-1243.

Lessard, D. R. (1991). Global competition and corporate finance in the 1990s. *Journal of applied corporate finance, 3*(4), 59-72.

Levi, M. (1994). Evidence on exchange rates and valuation of firms. In Y. Amihud & R. M. Levich (Eds.), *Exchange rates and corporate performance* (pp. 37-48). New York, NY: Irwin Professional.

Li, D., Moshirian, F., Wee, T., & Wu, E. (2009). Foreign exchange exposure: Evidence from the U.S. insurance industry. *Journal of International Financial Markets, Institutions and Money, 19*(2), 306-320. doi: http://dx.doi.org/10.1016/j.intfin.2008.01.003

Lievenbrück, M., & Schmid, T. (2014). Why do firms (not) hedge? — Novel evidence on cultural influence. *Journal of Corporate Finance, 25*, 92-106. doi: http://dx.doi.org/10.1016/j.jcorpfin.2013.10.010

Lim, C. F., & Meera, A. K. M. (2010). Managing foreign exchange risk: the Malaysian experience in the 1997 financial crisis. *Philippine Review of Economics, 44*(1).

Lin, C.-M., Phillips, R. D., & Smith, S. D. (2008). Hedging, financing, and investment decisions: Theory and empirical tests. *Journal of Banking & Finance, 32*(8), 1566-1582. doi: http://dx.doi.org/10.1016/j.jbankfin.2007.11.014

Lind, D. A., Marchal, W. G., & Wathen, M. (2012). *Basic Statistics for Business & Economics*. New York, NY: McGraw-Hill.

Loudon, G. (1993). The foreign exchange operating exposure of Australian stocks. *Accounting & Finance, 33*(1), 19-32.

Manchiraju, H., Pierce, S., & Sridharan, S. (2014). *Do firms use derivatives for hedging or non-hedging purposes? Evidence based on SFAS 161 disclosures*. Paper presented at the Sixth ISB Accounting Research Conference, Hyderabad, India.

Mark, N. C. (1990). Real and nominal exchange rates in the long run: An empirical investigation. *Journal of International Economics, 28*(1-2), 115-136.

Marshall, A., Kemmitt, M., & Pinto, H. (2012). The determinants of foreign exchange hedging in Alternative Investment Market firms. *The European Journal of Finance, 19*(2), 89-111. doi: 10.1080/1351847X.2012.659267

Marston, R. C. (2001). The effects of industry structure on economic exposure. *Journal of International Money and Finance, 20*(2), 149-164.

Martin, A. D., & Mauer, L. J. (2005). A note on common methods used to estimate foreign exchange exposure. *Journal of International Financial Markets, Institutions and Money, 15*(2), 125-140. doi: http://dx.doi.org/10.1016/j.intfin.2004.03.003

Mayers, D., & Smith, C. W. (1982). On the corporate demand for insurance. *Journal of Business*, 281-296.

McFadden, D. (1973). Conditional logit analysis of qualitative choice behavior. In P. Zarembka (Ed.), *Frontiers in Econometrics*: Academic Press.

Mello, A. S., & Parsons, J. E. (1995). Maturity structure of a hedge matters: lessons from the Metallgesellschaft debacle. *Journal of applied corporate finance, 8*(1), 106-121.

Mello, A. S., & Parsons, J. E. (2000). Hedging and Liquidity. *Review of Financial Studies, 13*(1), 127-153. doi: 10.1093/rfs/13.1.127

Mian, S. L. (1996). Evidence on corporate hedging policy. *Journal of Financial and Quantitative Analysis, 31*(3).

Miller, K. D., & Reuer, J. J. (1998a). Asymmetric corporate exposures to foreign exchange rate changes. *Strategic Management Journal, 19*(12), 1183-1191.

Miller, K. D., & Reuer, J. J. (1998b). Firm Strategy and Economic Exposure to Foreign Exchange Rate Movements. *Journal of International Business Studies, 29*(3), 493-513.

Modigliani, F. (1980). Introduction in a Abel (ed), The Collected Papers of Franco Modigliani, Vol. 3, pp. xi–xix: Cambridge, Massachusetts. MIT Press.

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review, 48*(3), 261-297.

Moraly, A. (2011). *International Robbery of US Wealth*: Xlibris Corporation.

Muller, A., & Verschoor, W. F. (2007). Asian foreign exchange risk exposure. *Journal of the Japanese and International Economies, 21*(1), 16-37.

Muller, A., & Verschoor, W. F. C. (2006). European Foreign Exchange Risk Exposure. *European Financial Management, 12*(2), 195-220. doi: 10.1111/j.1354-7798.2006.00316.x

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*(2), 147-175.

Nance, D. R., Smith, C. W., & Smithson, C. W. (1993). On the determinants of corporate hedging. *The Journal of Finance, 48*(1), 267-284.

Nguyen, H., & Faff, R. (2002). On The Determinants of Derivative Usage by Australian Companies. *Australian Journal of Management, 27*(1), 1-24. doi: 10.1177/031289620202700101

Nguyen, H., & Faff, R. (2003a). Can the use of foreign currency derivatives explain variations in foreign exchange exposure?: Evidence from Australian companies. *Journal of Multinational Financial Management, 13*(3), 193-215. doi: http://dx.doi.org/10.1016/S1042-444X(02)00051-8

Nguyen, H., & Faff, R. (2003b). Further evidence on the corporate use of derivatives in Australia: the case of foreign currency and interest rate instruments. *Australian Journal of Management, 28*(3), 307-317.

Nguyen, H., & Faff, R. (2010). Are firms hedging or speculating? The relationship between financial derivatives and firm risk. *Applied Financial Economics, 20*(10), 827-843. doi: 10.1080/09603101003636204

Nguyen, H., Faff, R., & Marshall, A. (2007). Exchange rate exposure, foreign currency derivatives and the introduction of the euro: French evidence. *International Review of Economics & Finance, 16*(4), 563-577.

Nydahl, S. (1999). Exchange rate exposure, foreign involvement and currency hedging of firms: some Swedish evidence. *European Financial Management, 5*(2), 241-257. doi: 10.1111/1468-036X.00091

Panaretou, A. (2013). Corporate risk management and firm value: evidence from the UK market. *The European Journal of Finance, 20*(12), 1161-1186. doi: 10.1080/1351847X.2013.766625

Pantzalis, C., Simkins, B. J., & Laux, P. A. (2001). Operational hedges and the foreign exchange exposure of US multinational corporations. *Journal of International Business Studies, 32*(4), 793-812.

Parsley, D. C., & Popper, H. A. (2006). Exchange rate pegs and foreign exchange exposure in East and South East Asia. *Journal of International Money and Finance, 25*(6), 992-1009.

Pillay, S. S., & Rangel, G. (2002). Are Values of Malaysian Companies Affected By Foreign Exchange Rate Changes? *Malaysian Finance Association (MFA), 10*(1), 1-22.

Priestley, R., & Ødegaard, B. A. (2002). New evidence on exchange rate exposure. *Norwegian school of management working paper*.

Priestley, R., & Ødegaard, B. A. (2007). Linear and nonlinear exchange rate exposure. *Journal of International Money and Finance, 26*(6), 1016-1037. doi: http://dx.doi.org/10.1016/j.jimonfin.2007.05.001

Pritamani, M. D., Shome, D. K., & Singal, V. (2004). Foreign exchange exposure of exporting and importing firms. *Journal of Banking & Finance, 28*(7), 1697-1710. doi: http://dx.doi.org/10.1016/j.jbankfin.2003.06.002

Purnanandam, A. (2008). Financial distress and corporate risk management: Theory and evidence. *Journal of Financial Economics, 87*(3), 706-739. doi: http://dx.doi.org/10.1016/j.jfineco.2007.04.003

Raghavendra, R., & Velmurugan, P. (2014). The Determinants of Currency Hedging in Indian IT Firms. *Journal of Business & Financial Affairs, 3*(3), 1-7.

Ramasamy, B. (2000). *Foreign Exchange Rate Exposure During a Financial Crisis: The Case of Malaysian Multinationals*: Citeseer.

Rødseth, A. (2000). *Open Economy Macroeconomics*: Cambridge University Press.

Ross, M. P. (1996). Corporate hedging: What, why and how? *University of California, Berkeley*.

Ross, M. P. (1998). *Dynamic optimal risk management and dividend policy under optimal capital structure and maturity*: Citeseer.

Rossi Júnior, J. L. (2007). The use of currency derivatives by Brazilian companies: an empirical investigation. *Brazilian Review of Finance, 5*(2), pp. 205-232.

Rossi Júnior, J. L. (2012). Understanding Brazilian companies' foreign exchange exposure. *Emerging Markets Review, 13*(3), 352-365.

Schiozer, R. F., & Saito, R. (2009). The Determinants of Currency Risk Management in Latin American Nonfinancial Firms. *Emerging Markets Finance and Trade, 45*(1), 49-71. doi: 10.2753/REE1540-496X450104

Servaes, H., Tamayo, A., & Tufano, P. (2009). The Theory and Practice of Corporate Risk Management. *Journal of applied corporate finance, 21*(4), 60-78.

Shaari, N. A., Hasan, N. A., Palanimally, Y. R., & Mohamed, R. K. M. H. (2013). The Determinants of Derivative Usage: A study on Malaysian firms. *INTERDISCIPLINARY JOURNAL OF CONTEMPORARY RESEARCH IN BUSINESS, 5*(2).

Shapiro, A. C. (1975). Exchange rate changes, inflation, and the value of the multinational corporation. *The Journal of Finance, 30*(2), 485-502.

Sheedy, E. (2006). Corporate risk management in Hong Kong and Singapore. *Managerial Finance, 32*(2), 89-100. doi: doi:10.1108/0307435061064188

Shin, H.-H., & Soenen, L. (1999). Exposure to currency risk by US multinational corporations. *Journal of Multinational Financial Management, 9*(2), 195-207. doi: http://dx.doi.org/10.1016/S1042-444X(98)00051-6

Shiu, Y.-M. (2007). An empirical investigation on derivatives usage: evidence from the United Kingdom general insurance industry. *Applied Economics Letters, 14*(5), 353-360.

Smith, C. W. (1995). Corporate risk management: theory and practice. *The Journal of Derivatives, 2*(4), 21-30.

Smith, C. W., & Stulz, R. M. (1985). The determinants of firms' hedging policies. *Journal of Financial and Quantitative Analysis, 20*(4), 391-405.

Smith, C. W., & Warner, J. B. (1979). On financial contracting: An analysis of bond covenants. *Journal of Financial Economics, 7*(2), 117-161. doi: http://dx.doi.org/10.1016/0304-405X(79)90011-4

Sprcic, D. M., & Sevic, Z. (2012). Determinants of corporate hedging decision: Evidence from Croatian and Slovenian companies. *Research in International Business and Finance, 26*(1), 1-25. doi: http://dx.doi.org/10.1016/j.ribaf.2011.05.001

Stulz, R. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics, 26*(1), 3-27.

Stulz, R. M. (1996). Rethinking risk management. *Journal of applied corporate finance, 9*(3), 8-25.

Tabachnick, B. G., Fidell, L. S., & Osterlind, S. J. (2001). *Using multivariate statistics* (5th Ed.). Boston: Pearson Education Incorporation.

Tai, C.-S. (2008). Asymmetric currency exposure and currency risk pricing. *International Review of Financial Analysis, 17*(4), 647-663. doi: http://dx.doi.org/10.1016/j.irfa.2007.09.002

Thomas-Olivier, L. (2007). *Corporate Risk Management for Value Creation: A Guide to Real-life Applications*: Risk Books.

Tse, Y. K., & Tsui, A. K. C. (1997). Conditional volatility in foreign exchange rates: Evidence from the Malaysian ringgit and Singapore dollar. *Pacific-Basin Finance Journal, 5*(3), 345-356. doi: https://doi.org/10.1016/S0927-538X(97)00002-4

Tu, Y.-K., Kellett, M., Clerehugh, V., & Gilthorpe, M. S. (2005). Problems of correlations between explanatory variables in multiple regression analyses in the dental literature. *British dental journal, 199*(7), 457-461.

Tuan-Hock, N., Lee-Lee, C., & Hishamuddin, I. (2012). Is the risk management committee only a procedural compliance?: An insight into managing risk taking among insurance companies in Malaysia. *The Journal of Risk Finance, 14*(1), 71-86. doi: doi:10.1108/15265941311288112

Tufano, P. (1996). Who manages risk? An empirical examination of risk management practices in the gold mining industry. *The Journal of Finance, 51*(4), 1097-1137.

Tufano, P. (1998). Agency Costs of Corporate Risk Management. *Financial Management, 27*(1), 67-77. doi: 10.2307/3666152

Umezaki, S. (2006). *Monetary and Exchange Rate Policy in Malaysia before the Asian Crisis*. Institute of developing economies

Wang, P. (2009). *The Economics of Foreign Exchange and Global Finance*: Springer.

Wang, X., & Fan, L. (2011). The Determinants of Corporate Hedging Policies. *International Journal of Business and Social Science, 2*(6), 29-38.

Williamson, R. (2001). Exchange rate exposure and competition: evidence from the automotive industry. *Journal of Financial Economics, 59*(3), 441-475. doi: http://dx.doi.org/10.1016/S0304-405X(00)00093-3

Yatim, P. (2010). Board structures and the establishment of a risk management committee by Malaysian listed firms. *Journal of Management & Governance, 14*(1), 17-36. doi: 10.1007/s10997-009-9089-6

Yip, W. H., & Nguyen, H. (2012). Exchange rate exposure and the use of foreign currency derivatives in the Australian resources sector. *Journal of Multinational Financial Management, 22*(4), 151-167. doi: http://dx.doi.org/10.1016/j.mulfin.2012.06.003

Zeidan, R., & Rodrigues, B. (2013). The failure of risk management for nonfinancial companies in the context of the financial crisis: lessons from Aracruz Celulose and hedging with derivatives. *Applied Financial Economics, 23*(3), 241-250.

Zhou, V. Y., & Wang, P. (2013). Managing foreign exchange risk with derivatives in UK non-financial firms. *International Review of Financial Analysis, 29*, 294-302. doi: 10.1016/j.irfa.2012.07.005